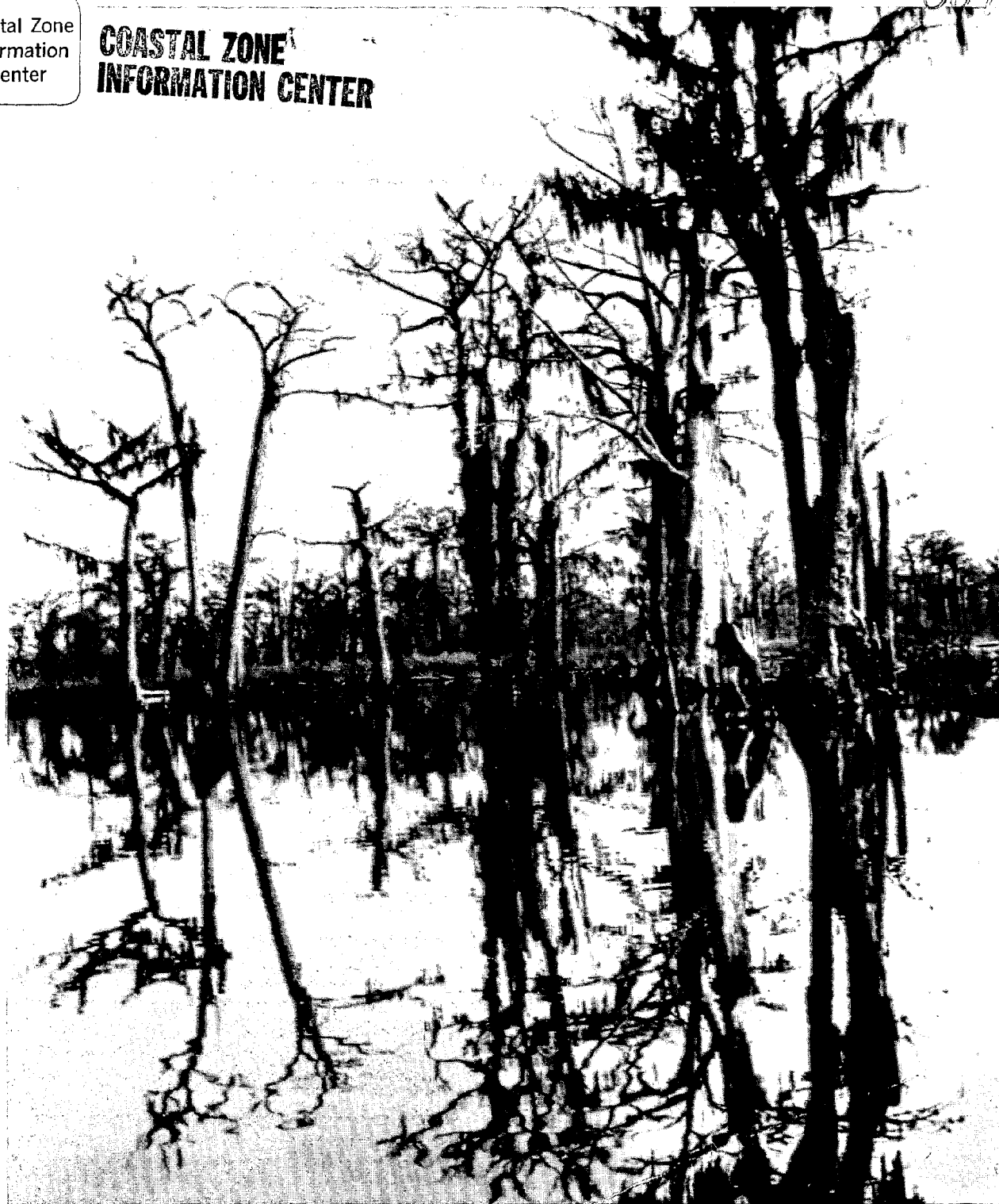


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Advisory Commission on Coastal & Marine Resources

LOUISIANA WETLANDS PROSPECTUS

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*Conclusions, Recommendations and
Proposals of the Louisiana Advisory
Commission on Coastal and Marine
Resources*

September, 1973

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LOUISIANA WETLANDS PROSPECTUS

Conclusions, Recommendations and
Proposals of the Louisiana Advisory
Commission on Coastal and Marine
Resources

September, 1973

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Lyle S. St. Amant, Chairman, State Government
L. K. Benson, Vice Chairman, Landowners
Donald M. Bradburn, Conservation Groups
Alva H. Harris, Marine Scientist
Charles Janvier, Oil and Gas
Davy P. Laborde, Sr., Labor
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Marc J. Hershman
Executive Director

September 14, 1973

To the Governor and Legislators of Louisiana:

We are pleased to submit the final report of the Louisiana Advisory Commission on Coastal and Marine Resources, entitled Louisiana Wetlands Prospectus.

Though the Commission ends with the submission of this report, the job of building an effective coastal zone management program for Louisiana just begins. Many citizens, community leaders, businessmen and government officials have been awaiting our recommendations. They believe that the sound management of our unique and valuable coastal resources will allow Louisiana to prosper economically while our wetlands and coastal water are protected for present and future generations. We believe our work-product reflects this basic theme and will lead to a better Louisiana.

Serving on the Commission has been thoroughly stimulating and provocative. We hope this report contributes to a better understanding of coastal resource needs and problems, and leads to meaningful discussion of alternative courses, of action.

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PREFACE

This report answers two questions posed by Louisiana's legislators in 1971: What are the needs and problems Louisiana faces in the use of its coastal and marine resources now and in the future? What actions should state government take to insure the orderly, long-range conservation and development of Louisiana's coastal and marine resources?

In a two-year study, ten commissioners and a small research staff addressed these questions. Chapter One of this report sets the context in which the Commission worked and presents the general recommendations of the Commission. It can be viewed as a summary statement of the Commission's work. Chapters Two, Three and Four present an inventory of Louisiana's coastal resources, trends in the use of those resources and a series of specific recommendations for planning and managing growth and conservation in a wetlands environment. Chapter Five constitutes the Commission's recommended legal and administrative framework for a state-level Coastal Zone Program including a recommended draft statute. Chapter Six deals with critical questions surrounding ocean engineering and development, research and education, recreation, culture and tourism, and new technologic development as these problems affect the use of coastal and marine resources in Louisiana.

The Commission issued two Annual Reports which provide additional materials not contained in this report. The first, Louisiana Government and the Coastal Zone - 1972, analyzes the work of 23 state agencies which affect coastal and marine resource uses in the state. The second, Wetlands '73: Toward Coastal Zone Management in Louisiana assesses the need for coastal zone management in Louisiana in light of numerous project proposals currently being advanced, and analyzes the new federal Coastal Zone Management Act of 1972. Copies of these reports are still available.

Throughout its study the Commission maintained an Official Journal. The Journal contains over 100 items, consisting of minutes of meetings, technical presentations, official

communications and the transcripts of five public hearings. An index of Journal items is included as part of Appendix Four. The Official Journal will be placed in key libraries in Louisiana. Copies of the transcripts of public hearings, separate from the other items of the Journal, are available.

The Commission relied on research and studies already available in analyzing many issues. Time and money constraints prohibited any "field" or "primary" research. Appendix One is a description of some of the comprehensive studies reviewed by the Commission. References to other studies are included within chapters. Many additional references, too numerous to list, were used over the two-year period.

The Commission expended approximately \$120,000 of state funds during its two-year existence. No federal funds were used in carrying out the study. The assistance and support received from many persons in industry, government and universities, computed as part of the Commissions budget, would significantly raise the figure. Commissioners served without receiving any compensation. Approximately 400 man-days of Commissioners' time has been spent on Commission business.

Thanks must go to many people for their hard work over the two-year period. Special acknowledgment to the commission staff: Paul H. Templet, Assistant Director and Scientific Associate; J. Arthur Smith, III, Attorney and Legal Associate; Bobbie H. Holmes, Secretary and Office Manager; Edgar Bohner and Nita Laverdet, Technical Writers and Editors; and, Marilyn Miller, Typist and Production Specialist.

Our gratitude also to the following people who contributed to the report: Dr. Robert Pope, for his economic analysis; Joel Lindsey, for his census data analysis; Dr. James J. Hebrard, for his section on Louisiana birds; Mrs. Bobbie Young, for her technical drawings; and student research assistants Miles Davidson, William Pozzi, Charles Ramsey, and Elizabeth Williams.

Thanks also to Dean Paul M. Hebert for the use of offices and facilities at the L.S.U. Law Center; the Louisiana Sea Grant Program for technical and administrative assistance; Dr. Ted B. Ford, Professor of Marine Sciences, for invaluable advice and assistance; and to the many other Technical Advisors and Friends to the Commission who helped out on many occasions.

Marc J. Hershman
Executive Director

September, 1973

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CHAPTER ONE

LOUISIANA'S COASTAL ZONE PROGRAM

In 1971, Louisiana initiated a study effort involving ten commissioners* and a small professional staff to identify the important environmental and natural resource issues affecting the coastal zone of the state and to recommend to state government officials and interested persons what should be done about these issues. The Commission was designed as a forum for interest groups actively using coastal resources, in recognition of the fact that diverse interests (fisheries, oil and gas, landowners, state officials, agriculture, labor, conservation and navigation) have the most to gain by resolving conflicts over how Louisiana's coastal zone should be used. This chapter sets forth the economic, governmental and environmental context in which the Commission fulfilled its statutory responsibilities and presents the Commission's general recommendations, which can be viewed as a summary of the entire report. In addition, a five-year perspective for Louisiana's coastal zone program is presented.

Economic, Governmental and Environmental Context

The Commission's work has proceeded in the context of change--economic, governmental and environmental change. Since World War II, Louisiana's population has grown rapidly. The greatest growth has occurred in the coastal zone, primarily in urban areas. Much of the population movement to the coastal zone was spurred by the industrial and commercial growth of the area. Currently, most economic indicators point to an increase. Oil and gas, water transportation, construction, fisheries and many other industries have been key factors in this growth. Many of Louisiana's citizens receive substantial benefits from this growth as per capita income of coastal zone residents continues to rise faster than the national average.

However, the relatively rapid expansion has created increased competition for space and resources. The coastal zone now has sprawling urban areas, intensified demands for land, greater demands for water and utility services,

*Originally nine with a tenth added in 1972

heightened need for recreational areas, increased need for transportation services, increased sources of pollutants and waste products, and a generally higher demand for almost all natural resources. These increases are complicated further by three factors: First, they are occurring in a relatively small geographical region of the state where there are natural constraints, such as large expanses of coastal bays and marshes. Second, Louisiana's coastal bays and marshes, in their natural condition are necessary to support fish and wildlife resources thus creating pressures to inhibit growth in these areas. Third, Louisiana's coastal zone is susceptible to floods and hurricanes every year, thereby adding another constraint on expansion in the coastal zone.

Thus, fast development within the context of coastal Louisiana's geography has led to increased competition for space and resources. This increased competition frequently results in conflict. State government, through services, regulatory programs and the judicial process, normally carries the burden of resolving these conflicts.

The Commission was created because key state officials recognized that conflicts were increasing but that state government did not have the tools to resolve the conflicts. Hence, the Commission was established for a dual purpose--to identify the needs and conflicts in use of coastal and marine resources, if any, and to appraise the role of government in resolving them. In the Commission's enabling statute (Act 35 of 1971), this dual role is stated in these terms: First, the Commission must provide for the orderly, long-range conservation and development of coastal and marine resources and, second, the Commission must recommend a coastal zone management plan to include implementing procedures.

While pursuing its statutory responsibilities, the Commission's eye was affixed firmly on four parallel trends: reforms in Louisiana state government, environmental and resource management trends at the state level, federal statutory and administrative trends, and the increasing scientific and technical evidence regarding the value and use of wetlands and coastal waters.

Although the Commission was appointed in the last few months of the McKeithen administration, most of its work has been done during the Edwards administration. The Edwards administration has been instituting changes and administrative reforms to establish governmental policies necessary for a fast-growing state. A Constitutional Revision Convention is currently working to revise the state's long and cumbersome constitution. Studies are in progress to reorganize levee

boards, transportation agencies, environmental agencies and others. Key equipment and facilities are being pooled to save state resources. Budgeting and accounting procedures are being tightened for greater state efficiency.

In addition, the Edwards administration has put greater emphasis on planning. A growth and conservation policy is being developed for the state by the Office of State Planning. Regional planning commissions have been supported and encouraged. Long-term studies are in progress for regional airports and deep water port facilities. Throughout its work, the Commission has been cognizant of these governmental reforms.

Changes in state and federal environmental programs also have influenced the Commission's work. Prior to 1970, the environmental impact of projects in the coastal zone was reviewed at the state level by the Wild Life and Fisheries Commission or the Louisiana State Health Department for impact upon air, water and wildlife resources. The Wild Life and Fisheries Commission, although primarily responsible for managing and protecting the fish and wildlife resources of the state, assumed responsibility for general environmental review of projects when required under federal law. After 1970, with more stringent federal legal requirements and more environmental awareness by citizens and the news media, changes started occurring in Louisiana's environmental protection program.

The Joint Legislative Committee on Environmental Quality* has initiated most of these changes. Among the Committee's legislative accomplishments have been the creation of three new environmental agencies and the strengthening of existing pollution control statutes. The Louisiana Advisory Commission on Coastal and Marine Resources (Act 35 of 1971), the Governor's Council on Environmental Quality (Act 460 of 1972), and the Citizen's Advisory Board to the Governor's Council on Environmental Quality (Act 460 of 1972) were all measures proposed by the Joint Legislative Committee.

Other national trends in environmental matters have influenced the Commission's work. Starting in the mid-1960s, Congress made substantial changes in air and water pollution control programs, culminating in the Clean Air Act of 1970 and the Federal Water Pollution Control Act of 1972. These landmark measures provide significant powers in the federal government to control air and water pollution. During this period, controls over land uses at the federal level were limited to comprehensive planning under Housing and Urban

*Chaired by Senator Samuel B. Nunez Jr. and originally established under Senate Concurrent Resolution No. 8 (1970).

Development (HUD) planning assistance programs and River Basin funding programs, numerous recreation and conservation laws, and the Fish and Wildlife Coordination Act.

In 1970 the National Environmental Policy Act became effective. It requires that environmental impact statements shall be prepared for all major federal actions significantly affecting the quality of the human environment. This Act has had a significant influence on many development projects throughout the nation.

Recently, federal coastal zone and land use management programs designed to encourage states to exercise greater authority over land use decision-making have received much attention. Many federal bills have been introduced to meet specific needs and purposes, such as the energy crisis, deep water ports, power plant siting, and routing pipelines through Alaska. Since Louisiana must live within the framework of federal law, the Commission followed these developments closely.

In recent years, there has been an increasing awareness of the value of wetlands as producers of much of the nation's fish and wildlife resources. The Commission paid close attention to this matter because of the extensive wetlands within Louisiana's coastal zone. The National Estuary Study and the National Estuarine Pollution Study, both in the late 1960's began to document, on a national scale, the value of wetlands. Recent scientific studies have indicated that Louisiana's extensive coastal marshes produce more fish and wildlife resources than any other marsh area in the United States.

Thus, the backdrop for the Commission's work was based upon an awareness that: (1) governmental procedures had to be reformed to resolve conflicts from increased competition for space and resources in the coastal zone, (2) the Edwards administration was instituting reforms in the administration of state government, (3) state and federal environmental laws were changing regularly and rapidly, and (4) wetlands and coastal waters, those "wastelands" of years past, were now being touted by many as one of our richest assets.

Defining the Study

Eleven subjects of coastal and marine resources management were to be considered under Act 35 (1971):

- Population growth and urbanization
- Land use
- Recreation

Waste management, water quality and pollution control
Water and power development
Transportation and trade
Engineering and technology
Marine science research and education
Monitoring of weather, climate and oceanographic conditions
Socio-economic and legal matters
Federal plans for coastal zone management

These subjects were studied with a view toward meeting five objectives:

- Orderly and responsible use and development of coastal and marine resources,
- Protection of the natural environment by minimizing the destructive aspects of developmental uses,
- Advancement of knowledge, education and research in marine and coastal sciences,
- Effective use of scientific and engineering resources of public or private agencies of the state, and
- Cooperation of Louisiana with other governmental bodies, or public or private organizations.

Results of the two-year study were to be in two forms: (1) policies for adoption by administrative or legislative action, and (2) implementation mechanisms for the "Louisiana coastal zone management plan." (The methodology used by the Commission in meeting these tasks and objectives is set forth fully in the two annual reports of the Commission and in Appendix Four of this report.)

Since the objectives of Act 35 relate directly to developing a coastal zone management plan, a definition for "coastal zone management" was adopted:

Coastal zone management relates to the decision-making process employed in using the natural resources and the environment of the state in a manner which affects the coastal zone, a unique region of land-sea-air interaction, where a positive program can lead to the optimum uses of the resources and environment while protecting them for the benefit of future generations.

In simpler terms, what does "coastal zone management" mean? When the Louisiana Wild Life and Fisheries Commission sets the opening date for the shrimping season, or a landowner leases his tract for hunting and fishing, or the Mississippi River-Gulf Outlet is dredged, or fresh water from Bayou Lafourche is pumped to Terrebonne Parish because of salt water intrusion, we are witnessing decisions about uses of the coastal zone. They occur everyday and with more frequency as society becomes more complex.

Coastal zone management deals with the human resources of the coastal zone--the people and their economy, culture and quality of life. It deals with the living and nonliving resources of the coastal zone--the shrimp harvest, mineral production, wildfowl habitats and shell dredging. It relates to water, land and wetland resources--the Mississippi River and delta, vast marshlands, countless streams, natural and man-made levees.

Coastal zone management applies to unique land-sea-air interactions. The juncture of land and sea is a haven for commercial and recreational enterprises. It is home for trade centers, a retreat for vacationers, the site of major population centers, and a mecca for sportsmen and fishermen. The coastal zone is where the influence of the tide is evident, where saltwater and freshwater mix, where there are beaches, bays and barrier islands.

Coastal zone management, a positive statewide program, is not a series of restraints or long list of prohibitions. Coastal zone management identifies long-term and short-term objectives and sets forth a positive program to achieve those objectives. Coastal zone management can motivate and guide the private and public sectors, spur the design of new processes and technologies, stimulate new human uses and experiences, engineer partnership efforts, sponsor new facilities, create mechanisms for accommodating conflict, spur new education for the young and a change of consciousness for all.

Coastal zone management can enhance the value of great natural assets. Coastal Louisiana has tremendous assets--land, water and people. Louisiana is the only state with French-based culture, the Mississippi River and delta, the vast and rich coastal marshlands and the mineral productivity. A coastal zone management program in Louisiana would work to sustain those assets and increase their value. It would watch, treat and nourish those assets. It would insure that the assets are working for the people twenty or fifty years from now and preserve the options necessary to meet the future demands and needs of the people of Louisiana.

General Recommendations

The Commission addressed all subjects set forth under Act 35 but special emphasis was placed on the extensive wetlands and coastal waters of Louisiana and the impact development activities have had on them. Other states of the United States, in pursuing similar broad studies have taken different approaches. Some have emphasized marine (deep-water) ocean activity in their reports. Others have pressed for programs of social, economic and recreational development in their coastal zones. Since the vast wetlands and coastal waters are the primary physical feature of our coastal zone and provide economic and recreational benefits to so many, they were chosen as a centralizing theme for the Commission's report.

Reasons for this emphasis abound. Louisiana has extensive coastal marshes. These marshes have proved to be great natural producers of food. These vast marshlands and coastal waters sustain renewable resources which serve many commercial and recreational industries year after year. Almost all other coastal resource uses of Louisiana have an impact upon the marshland environment. Finally, land loss problems, proposed large dredge and fill projects, salt water intrusion into estuaries and other impacts may have adverse effects upon recreational and fisheries resources.

The Commission believes that the coastal resources program of Louisiana should give priority to the orderly use, protection and enhancement of the vast wetlands and coastal waters of the state in order to maintain their productivity and essential role in sustaining the state's fisheries and wildlife resources and recreational uses. This priority does not lessen in any way the importance of other aspects of coastal resource use, such as economic development or deep-ocean utilization but expresses the view that a first step in the program should be to focus on the most extensive physiographic feature of our coastal zone--the wetlands and coastal waters.

Defining the coastal zone of Louisiana has been one of the Commission's more difficult tasks. Act 35 defines the coastal zone as landward to the extent of marine influences, but this is begging the question of definition rather than answering it. When the Commission first started its work, U.S. Highway 190 and the area south of it was chosen as a working definition. When the Commission's inventory work was in progress, a 26-parish area was designated the coastal

zone for ease in gathering statistics and data. Finally, when discussing the regulatory scheme necessary for coastal zone management, the Commission realized that a more functional and precise definition would be needed. The following was decided upon:

The Commission recognizes that the resources of the coastal zone are complex, interdependent and unique necessitating planning and management for the coastal zone on a regional basis, with full coordination between coastal and noncoastal planning and management programs. Accordingly, for this report, "coastal zone" shall mean the coastal waters and the shorelands, strongly influenced by the coastal waters and in proximity to the shoreline, including transitional and intertidal areas, marshes, swamps, natural levees and beaches within the following parishes:

Acadia, Ascension, Assumption, Calcasieu, Cameron, East Baton Rouge, Iberia, Iberville, Jefferson, Jefferson Davis, Lafourche, Lafayette, Livingston, Orleans, Plaquemines, St. Bernard, St. Charles, St. James, St. John, St. Martin, St. Mary, St. Tammany, Tangipahoa, Terrebonne, Vermilion, and West Baton Rouge. The coastal zone extends seaward to the territorial limits of the state of Louisiana. For planning purposes, all the territory within the above named 26 parishes shall be included. "Coastal waters" means bays, coves, lagoons, lakes, inlets, sounds, estuaries, rivers, streams, bayous, or other bodies of water (including the beds and bottoms thereof), in direct connection with or which drain into the open sea or which are affected by the ebb and flow of the tide. (Fig. 1.1)

The Commission believes that many activities outside the coastal zone, but within the territorial limits of the state, have an impact upon coastal resources and should be regulated under a coastal zone management program. For example, water management projects along the Mississippi River or Sabine River, though occurring many miles north of the coastal zone, have had an impact upon water flow into the coastal zone, which, in turn, has measurably altered or adversely affected coastal resource use. Although most regulatory activities would occur in the 26-parish area, the jurisdiction of the Coastal Resources Commission recommended in Chapter Five is statewide. Those uses of lands and waters outside the coastal zone, which may measurably alter or adversely affect the coastal zone, are subject to the Commission's jurisdiction. Construction on land which does not affect water flow and water quality, however, is not subject to the Commission's jurisdiction.

An inventory of Louisiana's coastal zone resources and an analysis of trends and projections of uses of the coastal zone have shown that the coastal zone of this state is its richest and fastest growing sector. As stated earlier, population growth and economic indicators (e.g. per capita income, total wages paid and total industrial investments) are increasing, and increasing faster in the coastal zone than in the rest of the state. As mentioned earlier, the Commission focused much of its attention on the state's wetlands and coastal waters. Since fisheries production is one of the measures of the health of the coastal ecosystem, special attention was paid to trends in production of fish and shellfish and to certain other key indicators of marsh and estuary viability--saltwater intrusion, pollution of estuaries, and land loss.

The Commission notes that total fisheries production is on the increase in the coastal zone and that this has occurred while there has been intensive multiple use of the wetlands and coastal waters. However, there are certain trends which, if not studied carefully, monitored closely and perhaps checked, could result in damage, in the long run, to coastal marsh and estuary productivity. These trends are:

(1) Increasing acreages are being closed by pollution to oyster harvesting.

(2) Oyster yields per acre have decreased tenfold in the last 30 years.

(3) Shrimp catch per boat has decreased ninefold in the past 30 years.

(4) Saltwater continues to intrude farther inland.

(5) Wetlands are being lost at a net rate of 16.5 square miles per year.

The Commission does not and cannot point to any one coastal user group as primarily responsible, or even significantly responsible, for these trends. It is the combination of many diverse uses of the coastal environment, working in an era of fast growth, and a geographic region of low-lying, flood and hurricane prone wetlands, which has brought about the conditions now being studied and analyzed so carefully. It is clear, however, that insufficient attention has been given to planning and managing conservation and growth in the Louisiana

coastal zone region. Growth and development has been foremost. Conservation and environmental impact considerations have not been adequate.

The Commission recommends that Louisiana's fundamental policy be to encourage full use of coastal resources by as many citizens as possible subject to five additional policies:

(1) Water flow, water circulation, water quantity and quality are the single most important factors of wetlands systems, and the impact of uses on these factors needs careful review prior to their authorization.

(2) Impact of uses on coastal marshes and estuaries must be measured on a regional or ecosystems basis so that the cumulative impact of many small uses can be assessed in terms of the viability and productivity of the region or system.

(3) Proposed land uses in the coastal zone must be assessed in terms of the intrinsic suitability of the site for the proposed use.

(4) Transportation and utility systems must be designed to encourage urban and industrial growth in corridors where it is best suited, and discourage such growth in wetland areas which are substantially undisturbed.

(5) Multiple use and economically diversified uses must be preferred over single-purpose uses of the coastal zone.

To be implemented, these policies need a revitalized state government program with technical expertise and sensitivity to interest group and citizen needs. Louisiana's current coastal zone management effort has been assumed by the Louisiana Wild Life and Fisheries Commission as a peripheral responsibility to their primary duties as managers of the fish and wildlife resources of the state. They have not been organized properly, nor budgeted adequately, to do the job. The effectiveness of any program to plan and manage the resources of the coastal zone is determined by the organizational structure of the agency, the powers designated to it, the professionalism of its staff and the budgetary resources provided.

The Commission believes the Louisiana Coastal Zone Program should be directed by a new Coastal Resources Commission, consisting primarily of qualified representatives of coastal user groups, and including state and local government representatives. Its planning and regulatory powers should be sufficient to implement the policies enumerated in the previous recommendation. The Commission should direct three distinct subunits: a management unit (recommended to be assigned to the Louisiana Wild Life and Fisheries Commission), a planning unit (recommended to be a responsibility of the State Planning Office), and a research unit (recommended to be a responsibility of the Louisiana Sea Grant program). Full advantage should be taken of existing personnel, equipment and funding sources hence assignment of subunits to existing agencies is recommended over creation of new subunits. Procedures should be established whereby all significant uses of lands and waters which measurably alter or adversely affect the coastal zone would require a permit. The Coastal Resources Commission should establish rules, regulations, criteria and standards to implement the permit program. Procedural safeguards, including the right of appellate review, should be provided.

A fully developed coastal zone program for Louisiana, however, would go beyond the planning and management functions outlined above. The Commission recognizes that without an effective coastal and marine education and research program, the people of the state may not appreciate the need for the planning and management program. Similarly, Louisiana's stake in deep-ocean resources and the economic benefits they have brought to the state merits the attention of a special ocean engineering and development effort. Further, the Commission fully recognizes the need for a well-developed recreation, culture and tourism effort in the state, if the unique traits and customs of the people of south Louisiana are to be appreciated by our own citizens and those of the region and nation. Finally, new technologies and concepts may yield greater benefits to the state, and solve some of our current problems. The Commission encourages current research and development efforts in mariculture, erosion control, controlled deposition of sediment, hovercraft, waste disposal, and superports.

FIVE YEAR PERSPECTIVE

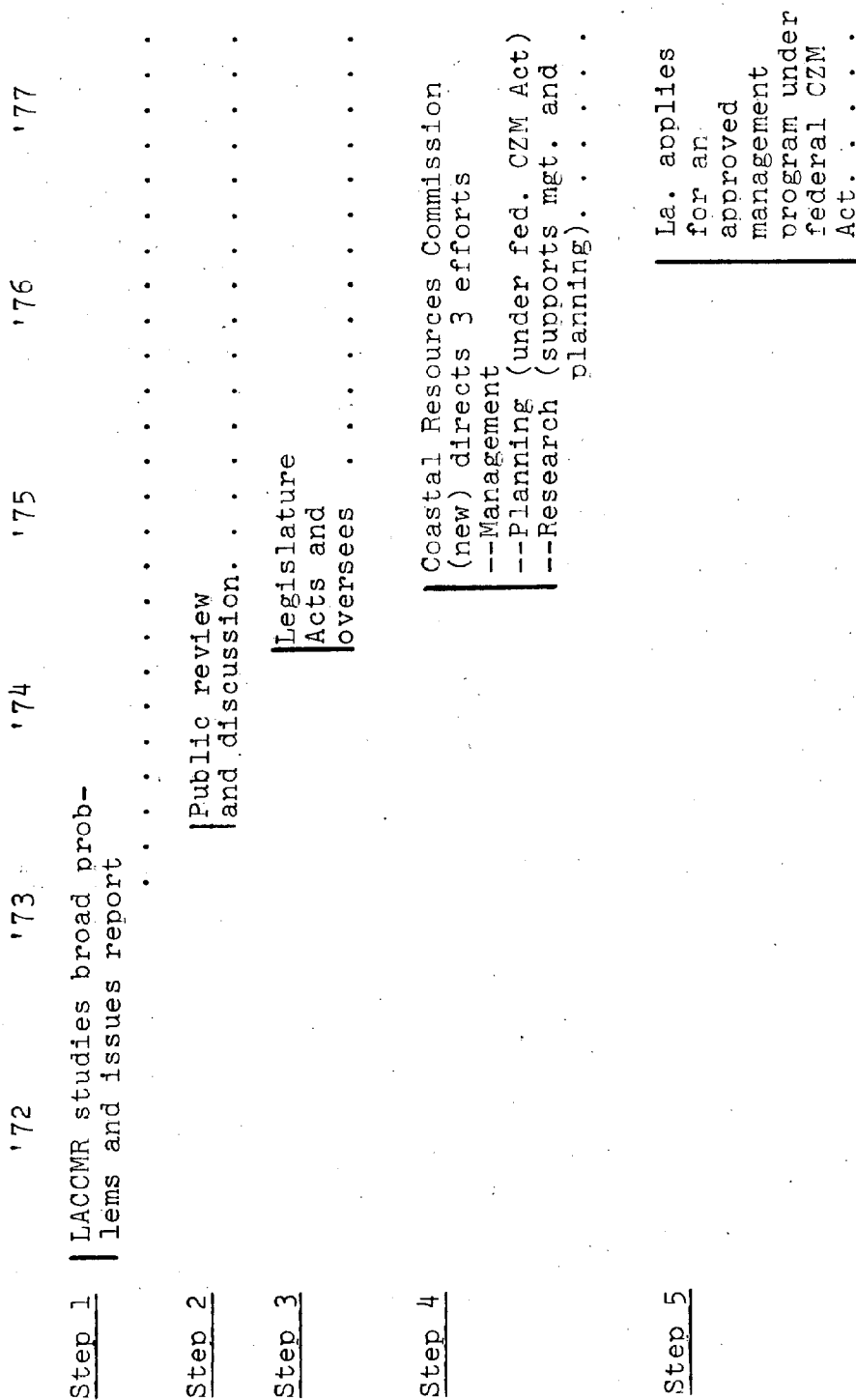


Fig. 1.2

Louisiana's Coastal Zone Program--A Five-Year and Five-Step Perspective

Louisiana's coastal zone program should involve five steps over the next five years (Fig. 1.2). Step One ends with the submission of this report. Step two should begin immediately upon release of this report. The Commission did as much as it could, considering time and money constraints, to involve the public in its deliberations. However, now that a specific proposal for a coastal zone program for Louisiana is set forth, the state should launch an intensive public education and review effort.

The Louisiana coastal zone program should foster full and open participation by local governments, interest groups and citizens at all levels of planning, policy formulation and decision-making. More specifically, the Commission recommends that the period from September 15, 1973, until the legislature deals with the recommendations of the Commission, be designated by the Governor as a period of discussion and review of the coastal zone program recommendations to include public hearings and a public education program. This intensive review should be designed to receive comment and review by interest groups, state and local officials and citizens. The results of the review should be made available to the public.

Step three would consist of legislative action to enact the Coastal Zone Program into law and provide funds for its operation. The Commission has recommended a statute for consideration by the legislature. The legislature must decide whether this is the approach it wishes to take. It is hoped that the legislature will benefit from the intensive public education and review effort envisioned by step two.

Step four would begin when the Coastal Zone Program actually begins its operations. Personnel must be hired and their jobs defined. Rules and regulations implementing the statute must be promulgated.

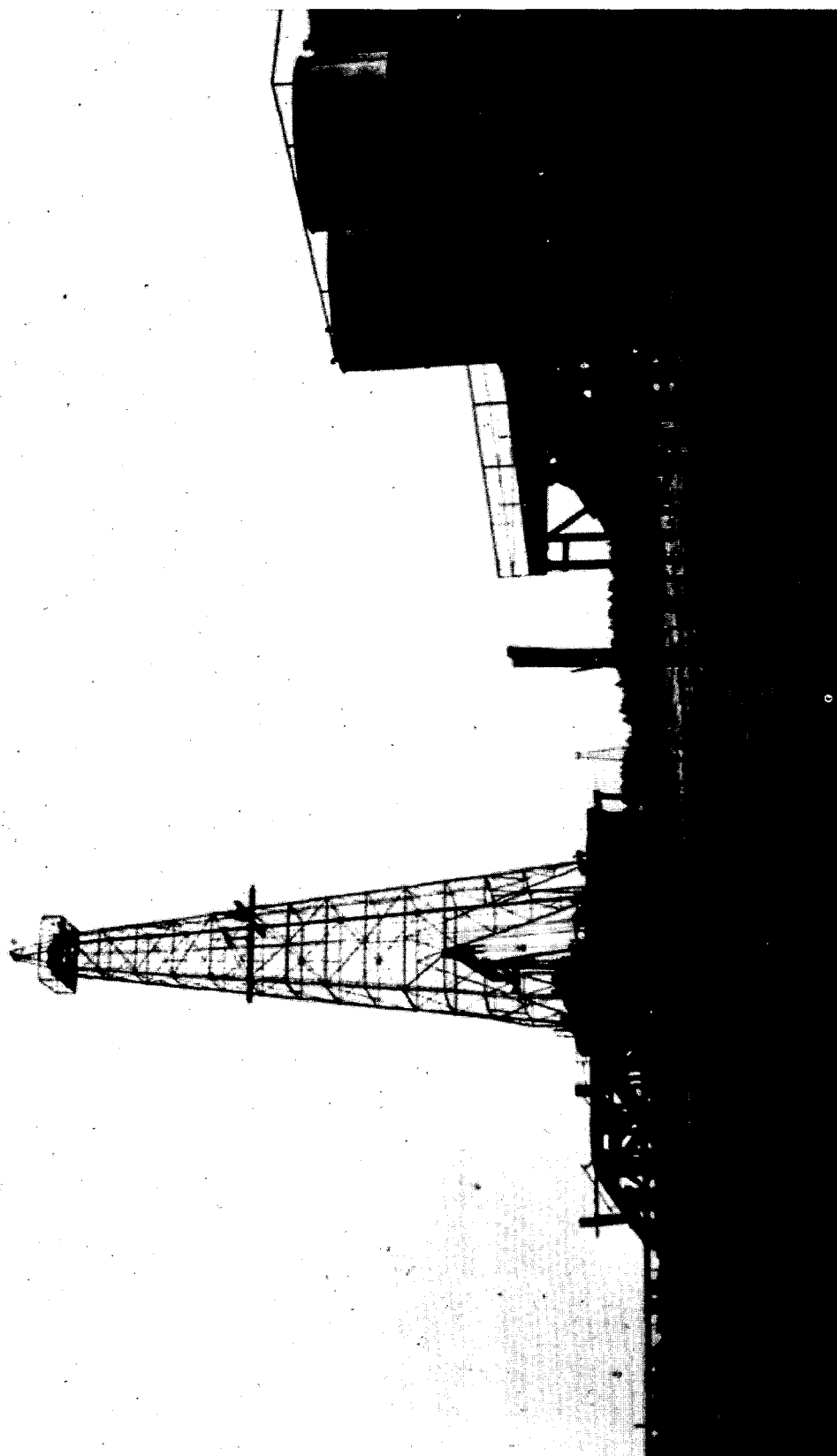
An essential function of the Coastal Resources Commission would be to enable the state to acquire an approved coastal management program under the federal Coastal Zone Management Act of 1972. Step five, estimated to occur two years after the

establishment of the Coastal Resources Commission, would occur when the state prepares and submits its management program to be approved by the U.S. Secretary of Commerce. Under the federal Act, considerable planning must be achieved before a coastal management program is submitted for approval: the boundaries of the coastal zone must be delimited specifically; permissible land and water uses must be identified; geographic areas of particular concern must be listed; the means for exerting state control over land and water uses must be set forth; priority uses within specific geographic areas throughout the coastal zone must be identified; and, an organization structure to implement the management program must be set forth. If adopted, the recommendations of this Commission would provide the legal framework necessary for a coastal management program but would not meet some of the specific technical requirements such as a listing of permissible land and water uses, an identification of geographic areas of particular concern and a designation of priority uses within specific geographic areas. These tasks must be accomplished to the satisfaction of the state and the federal agency prior to receiving a federally approved management program and federal funding. Once the management program is approved, the state will be in a much stronger position when dealing with federal agencies which issue permits and promote programs in Louisiana's coastal zone and will become eligible for significant grants to implement the management program.

The development of a coastal zone program as set forth in this Chapter and the remainder of this report will provide the state a mechanism for the orderly, long-range conservation and development of coastal and marine resources and an improved procedure for making decisions on coastal resource uses. Decisions made in light of long-term objectives and after a thorough scientific and technical evaluation should help the state improve the quality of life for its citizens now and in the future.



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CHAPTER TWO

AN INVENTORY OF LOUISIANA'S COASTAL ZONE

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CHAPTER TWO

AN INVENTORY OF LOUISIANA'S COASTAL ZONE

I. Introduction

According to the National Estuarine Pollution Study, "America's coastlines are fringed by a maze of wetlands, commonly identified as bays, sloughs, inlets, sounds, salt marshes, and lagoons. These sprawling and complex aquatic areas, where the fresh water of the rivers meets the salt water of the seas, are estuaries.

The 26 coastal States and territories of this Nation have more than 30 million acres of estuarine waters and wetlands. About one-third of the Nation's population lives and works in the 258 counties that border these regions, and about one-third of the Nation's industry is concentrated there."

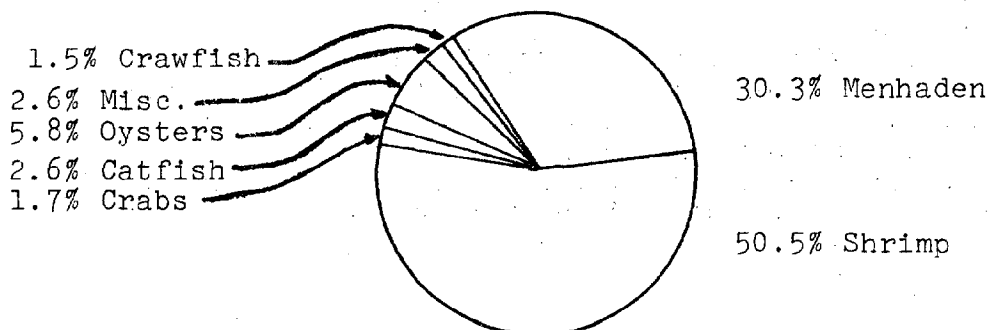
Of the 30 million acres of estuarine waters and wetlands nationally, Louisiana has over seven million acres--more than any other state. In these wetlands, and in the remainder of the coastal zone, lies the vast majority of Louisiana's people and industry. The activities of the people, their work and play, are closely tied to the uses of the resources of the coastal zone. The remainder of this chapter will explore the major uses of coastal zone resources.

II. Renewable Resources

A. Living Resources

1. Commercial Uses

In 1970, the commercial fish catch in Louisiana was valued at \$62,516,831. This take was distributed among five primary species of fishes and shell fish as follows:



The latest biennial report of the Louisiana Wild Life and Fisheries Commission lists 37 different fish and shellfish taken commercially. Of these, 6 varieties account for 97 per cent of the total value of the commercial fishing.(1) With the exception of catfish operations, commercial activity with respect to the other species of fish and shell fish is directly and almost exclusively related to the coastal zone area of the state. This subsection briefly outlines those relationships.

a. Menhaden (Pogie)

Menhaden is the principal industrial fish species taken in Louisiana. Although its flesh is too oily for human consumption, the oil is commercially valuable. Once the oil is removed, the remainder of the fish is used to make a cake which serves as a high protein livestock food supplement. In 1970, the menhaden catch was valued at \$18.9 million.(2)

Menhaden spawn offshore between October and February. Tidal currents carry the fingerlings, or small fish, into the shallow estuarine, or marsh, areas of the coast. Here, the fish develop and mature during the summer and migrate in the fall to the offshore spawning areas.(3)

Menhaden are taken with a purse seine by means of a highly mechanized procedure. Basically, a school is trapped in the purse seine and pumped aboard a larger fishing boat. Studies by the Louisiana Wild Life and Fisheries Commission indicate that few game fish are taken by this method and heavy fishing pressure appears to improve infant survival rate. Experience in Florida indicates that pollution of marsh areas where fingerlings develop can decimate schools, thereby destroying menhaden based industries.(4)

b. Crab

The blue Crab taken in Louisiana has an extremely wide natural range--from Nova Scotia as far south as Uruguay. In addition, it has been introduced to many European coastal areas.(5)

Female crabs with egg masses are found in the Gulf from December to October but they are more plentiful during March and April. The eggs hatch in offshore waters and once young crabs develop they return to the marsh area, where after 18 to 20 molts they reach maturity. Females mate once during their last molt. Males mate during the period

between their last three molts. To be successful, females must then move to the offshore areas while the males remain in the less saline onshore waters.

Crabs are cannibalistic. A molting crab is just a good meal for another of his species which happens along. Therefore, to survive, crabs need areas where cover is available. They are also especially sensitive to excessive concentrations of silt during the premolting, or buster, stage. Soft-shell crab fishermen who maintain cages have to be especially careful that the water supply is clean. (6)

In 1970, the Louisiana crab catch was valued at \$928,046 for hard-shell and \$79,462 for soft-shell crabs. (7)

c. Crawfish

Some 300 species of crawfish are known worldwide. Over 100 species are in the United States and 29 species have been identified in Louisiana. (8)

Female crawfish carry from 15 to 700 eggs, which hatch underground in September and October. They are then activated by warming water in spring. Crawfish prefer water temperature of 70°F to 85°F; when conditions are favorable, they mature in 60 to 90 days. The crawfish harvest occurs south of a line drawn from Lake Charles, northeast to Alexandria, southeast to Marksville, and east to Baton Rouge. This line almost describes the coastal zone area as defined for this report. (9) The Atchafalaya Basin area is the primary source of wild commercial crawfish. (10)

Crawfish will eat dead or living plants and animals but they prefer fresh meat. About 20 per cent of the crawfish diet consists of worm larvae and other relatively immobile animals. Growth is hampered when superfluous decaying material in water reduces the oxygen content. (11)

In 1971, about 24,000 acres were devoted to crawfish culture. The acreage has shown a steady increase in the past and the trend is expected to continue. Rice farming and crawfish culture have been found especially compatible. The 1970 crawfish catch was valued at \$945,463. (12)

d. Shrimp

The 1970 Louisiana shrimp catch was valued at \$24.61 million. Louisiana landings constituted 27 per cent of total shrimp landings in the United States. (13) The Wild Life

and Fisheries Commission issued more than 8,000 commercial trawler licenses that year. (14)

White and brown shrimp are the two commercially important species in Louisiana. Young brown shrimp move into the coastal waters between February and March. They mature in several months and are ready for harvest sometime in May. The Wild Life and Fisheries Commission sets the season based on the maturity of the shrimp population. Typically, the season will run from May 15 to July 15, and then reopen the third Monday in August and run until December 21. The short closing is intended to protect young white shrimp coming ashore during that time. They then also mature in the coastal waters and are ready for harvest in August. (15)

Shrimp fishermen use both trawls and wing nets. Generally, trawls are used in daylight operations and wing nets are used at night. (16)

Wide variations in shrimp catches occur from year to year. The Wild Life and Fisheries Commission is involved with the federal government in a shared cost research program to determine the cause of these fluctuations. To date, the studies have shown Louisiana estuarine waters contain by far the largest white and brown shrimp concentrations along the east and gulf coasts. It appears that fertile, low salinity estuaries provide a most favorable habitat. Elevated water temperature has also been observed to be a favorable factor. (17)

e. Oysters

The 1970 oyster harvest was valued at \$3.63 million. This represented a value decrease in excess of 25 per cent as compared to 1968. At least part of the loss can be blamed on destruction by Hurricane Camille. (18) There has also been a general decline in production caused by expanding industry, and changes in drainage resulting from flood control projects. (19)

In Louisiana, there are about 1,100 oyster fishermen operating an estimated 140,000 acres of oyster leases under the administration of the Wild Life and Fisheries Commission. (20)

Female oysters are stimulated by an increase in water temperature or presence of male sperm and release millions of microscopic eggs which hatch within a few hours. The

larvae develop for about two to four weeks, during which time they float free. Only a very small percentage survive. Once the oyster reaches spat stage, it attaches to a clean, hard surface and begins to feed by pumping about three gallons of water per hour through its shell, straining out microscopic plants and animals. Currently state-owned seed grounds east of the Mississippi River supply 80 per cent of seed oysters used in primary oyster-fishing areas between the Mississippi and Atchafalaya rivers. Once the oysters are set, only 1 per cent survive to maturity. The extremely high mortality rate is blamed largely on predators, such as the conch, or oyster drill, the salt water drum and disease, such as dermocystidium marinum, called D marinum for short. Previously oysters had been bedded and allowed to grow two years. Today, most oysters are bedded between September and November and are harvested before June.(21)

f. Fur and Hide

The primary commercial fur-bearing animals in the coastal zone area are nutria, muskrat and mink.(22) The total statewide fur catch was valued at about \$9.63 million for the 1972-73 season.(23) Of this total, 85 per cent was realized from muskrat and nutria trapping conducted almost exclusively in the coastal zone area. In addition to selling pelts, Louisiana trappers sell nutria and muskrat meat to the screwworm stabilization program.(24)

Not native to Louisiana, the nutria was brought to Avery Island in 1930 for testing. Few escaped during the normal course of experiments but in 1940, a hurricane destroyed the pens and the whole colony of about 300 got out. By 1957 the nutria was so plentiful that the Louisiana Legislature offered a bounty, which was not cancelled until 1968. Nutria range over the whole coastal zone area and are well adapted to survive in marsh and swamp environments.(25) Their outlaw status has been forgotten quickly because the value of the nutria catch during the 1972-73 season exceeded \$7.5 million.(26)

The muskrat is found primarily in marsh areas and has a special preference for three-cornered grass marsh. Conditions which develop this type of marsh seem to be ideal for muskrat habitat, e.g., relatively low salinity and stable water levels. Also, muskrats need a well developed peat root system for constructing runs and tunnels. Often, it is good management, from the muskrat trapper's point of view, to burn off and flood large marsh areas, thereby creating conditions favorable to three-cornered grass growth. Most productive marsh areas are between salt and

fresh water regimes. Extremely vulnerable to changes in water distributions, these marshes are limited in that they can feed only a certain number of muskrat. When population exceeds carrying capacity, muskrat literally eat up the marsh and destroy the habitat. This, of course, also decimates the muskrat populations.(27)

1. Alligators

The alligator population's steady decline since the 1930s is attributable to man's influence. An extensive network of canals was dredged making almost any area of the marsh easily accessible to hunters and trappers. These canals also increased circulation and caused changes in plant life. During the latter 1950s and throughout the 1960s, the Louisiana Wild Life and Fisheries Commission engaged in a major alligator management effort.(28) In 1972, an experimental open season was conducted in Cameron Parish from September 5 through 17 and 1,347 alligators were taken. The hides were sold at public auction and the gross value was \$74,614. Average value of hide per linear foot was \$8 and prime hides brought as much as \$11 per foot.(29)

Rules of the experimental season were set up to facilitate taking only male alligators. Inspection by Wild Life and Fisheries personnel indicated that about 80 per cent of the catch was male. Females use open water only during courtship and breeding periods and otherwise spend the great bulk of their time in isolated dens. Males can truly be classified as "play boys after dark." More active males have been known to travel four to five miles in a single night. They prefer relatively open water.(30)

2. Sport Uses

a. Hunting

During the 1970-71 Louisiana season, 338,953 resident hunting licenses were bought, about 43 per cent in the coastal zone parishes.(31) Primary game animals in the coastal zone area include waterfowl, rabbits, squirrel, snipe, rail and deer. There is some dove hunting but the more productive dove areas are north of the coastal zone. This subsection briefly discusses each of the more important species and its relationship to the coastal zone.

1. Deer

Deer generally range over the whole coastal zone area. Deer populations are relatively small compared with upland areas to the north.(32) Kills were reported in each of the coastal zone parishes but accounted for only 11 per cent of the deer killed in Louisiana during the 1970-71 hunting season.(33)

Research has shown that the quality of deer herds is dependent on two factors: heredity of the animals and quality of the range. High quality ranges provide sufficient browsing matter and cover.(34)

2. Squirrel

Squirrel season runs generally from early October to early January. The early season allows hunting while squirrels are still feeding. About 80 per cent of the kills are made then.(35)

Two primary species of squirrels are found in Louisiana: the grey and the fox squirrel. Grey squirrels are, as their name suggests, grey in color and usually smaller than the rust-colored fox squirrel. Coastal zone swamps provide excellent habitat for both species. The primary threat to the squirrel population is forest-clearing rather than hunting pressure. Hunters take only about 30 per cent of the annual squirrel crop.

3. Rabbit

Louisiana has two primary species of rabbit: cottontail, indigenous to upland areas, and swamp rabbits, usually found in low-lying swamp or marsh areas. Cottontails thrive on uncut fence rows and places with adequate cover.(36)

Generally, the rabbit's reputation for reproductive ability is well deserved. They are the basic link in the food chain for most predators; therefore, nature has provided for continuation of the species by giving them exceptional powers of reproduction. It can be that "as long as housing shortages do not interfere, mother nature will supply the rabbits." The observed decrease in rabbit population is caused by destruction of their habitat rather than by hunting.(37)

4. Waterfowl

A great variety of waterfowl winter each year in the coastal zone, which serves as the southern end of the Mississippi Fly-Way. During the 1972-73 winter, the coastal zone provided a home for about 4.5 million ducks and geese.(38)

There are about 120,000 duck hunters in Louisiana. Typically, the season open on or about November 4 and lasts about 50 days.

The waterfowl resource is dependent on the condition of the nesting grounds in the prairie provinces of Canada and on maintenance of a suitable winter habitat in Louisiana.(39) Considerable research is in progress, with a view to determining the best management methods to maintain the wintering areas.(40)

5. Fishing

Fishing is the fifth most popular form of recreation in Louisiana. In fact, the average Louisianan went fishing 3.13 times during the summer.(41)

Louisiana's freshwater game fish include large mouth bass, bream, white perch, or sac-a-lait, blue gill and red eared sunfish. Sport fishermen also actively seek catfish. As a group, these fish are distinguished by their preference for relatively warm water. Each of the species is distributed widely throughout the coastal zone.(42)

It has been observed generally that game fish can endure less variations in water quality than can rough fish. Game fish are the first species to die when oxygen content is reduced.(43)

The primary and most actively sought salt water game fish in the Louisiana coastal area are speckled trout (spotted weakfish) and the cahnnel bass, or red fish. Both mature and spend the greater part of their lives in the marshes and estuarine areas of the coastal zone.(44)

3. Other Living Resources

In addition to the species already discussed, there are others that provide benefits to man. Those benefits may be little recognized if man uses them only indirectly or their niche in the ecological cycles or food chains is obscure.

Birds provide much pleasure to the growing numbers of people who delight in watching them. Louisiana's coastal zone is famous for its birds.

The Gulf waters, beaches, marshes, and cheniers of Louisiana's coastal zone provide habitat at some time of year to a large proportion of the noncommercial bird species breeding in the Eastern United States and to an appreciable number of more western species.

Two place names that come up repeatedly when birds are discussed are Grand Isle and Cameron Parish.(45) These are the two most accessible areas on the Louisiana coast and probably receive more attention from ornithologists than any other section of the state. Accessibility is not, of course, the only reason these areas are so attractive to people interested in birds.

One of the more spectacular occurrences in the coastal region is the annual migration of hundreds of thousands of songbirds to and from their wintering grounds in the tropical countries to the south of the Gulf of Mexico. Detailed accounts of this migration can be found.(46, 47, 48, 49). Over 70 species of songbirds regularly cross the Gulf in spring almost every day beginning around the first of April and continuing until the middle of May. The great majority of these species usually begins migration shortly after sunset, fly all night and alight at dawn. Because of the length of the trans-Gulf flight, birds that leave Mexico and points south at sunset are over water at dawn and must continue flying until they reach land. Each day during the spring migration period, birds arrive over the Louisiana coast in tremendous numbers in the late morning and all afternoon. Most continue flying to inland forests, but during bad weather many land in chenier woods. When such a "fallout" occurs the cheniers are literally full of vireos, warblers, thrushes, tanagers, grosbeaks and buntings. Nowhere except on the northern coast of the Gulf of Mexico can such concentrations of songbirds be seen. This unique situation provides what might be called a "natural laboratory" for studies of bird migration. Preservation of these chenier ridges and the surrounding marshland are of great concern as the number of people who get pleasure from observing and studying birds continues to increase.

It is thought that man's effect on the birds of the coastal areas was quite noticeable even before the turn of the century. The Eskimo curley, once an abundant migrant through the state, was last reported here in 1889. Whooping cranes, once fairly common winter residents, were last seen in the state in 1918. Greater prairie chickens, an

unusual member of the grouse family, bred in southwestern Louisiana at one time but disappeared by 1919. To think that this process of elimination has ended would be foolhardy. One need only mention the brown pelican, a bird that in a relatively short time (20 years) has gone from one of the more common sights over the waters of the Gulf to an extreme rarity until recently reintroduced from stock imported from out of the state.

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B. Agriculture

1. General Characteristics

Parishes of the Louisiana coastal zone have generally been divided into three groups with respect to agriculture. Fig. 2.1 illustrates this division. First, parishes on the coast are characterized by large salt marsh area. About 2.3 million of the 5.3 million acres that make up these parishes are classified as saltwater marshland. The soils are brackish-marsh-peaty-muck. This marsh land is usually submerged throughout the year and subject to tidal overflow.

The second group of parishes, located just north of the coastal parishes, forms a band extending from the western end of Lake Pontchartrain to the Texas border. These parishes contain about four million acres, of which about 50 per cent is devoted to some type of farming. Soils in the western area are classified as coastal prairies and alluvium in the eastern section. The variable nature of these soils makes them easily adaptable for many agricultural uses.

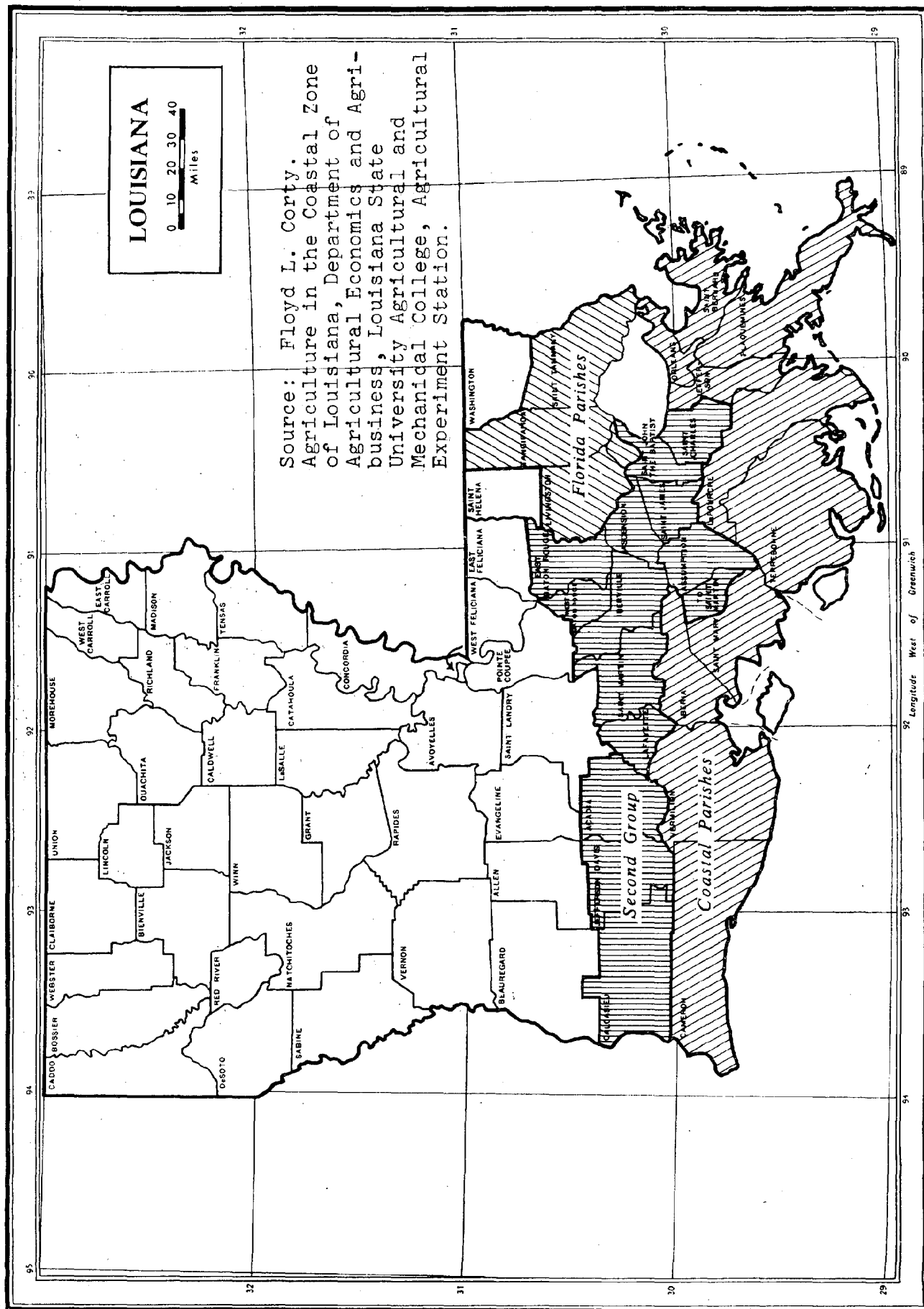
The third group of parishes, described as Florida Parishes, is located on the northern shore of Lake Pontchartrain. These parishes comprise a total land area of about 1.5 million acres. About 20 per cent of the land is devoted to farm use. Generally, it can be said that the area suitable for farming is limited; soils are poorly drained, shallow and silty.

Agricultural activity in the coastal zone is dominated by a few major crops. Each crop is generally raised in a specific area. Following is a discussion of each of the major crops.

2. Rice

Per capita consumption of rice in the United States is about seven pounds per person. In some parts of Asia, consumption exceeds 300 pounds per person. Since World War II, the United States has joined Thailand and Burma as a major rice exporting nation. Today, most of the United States crop is grown in Louisiana, Arkansas, Texas and California and about half the crop is exported.(1)

The rice growing area of the Louisiana coastal zone (Fig. 2.2) includes most of southwestern Louisiana. In most general terms, rice is planted in April and May, cultivated in May, June and July and harvested from



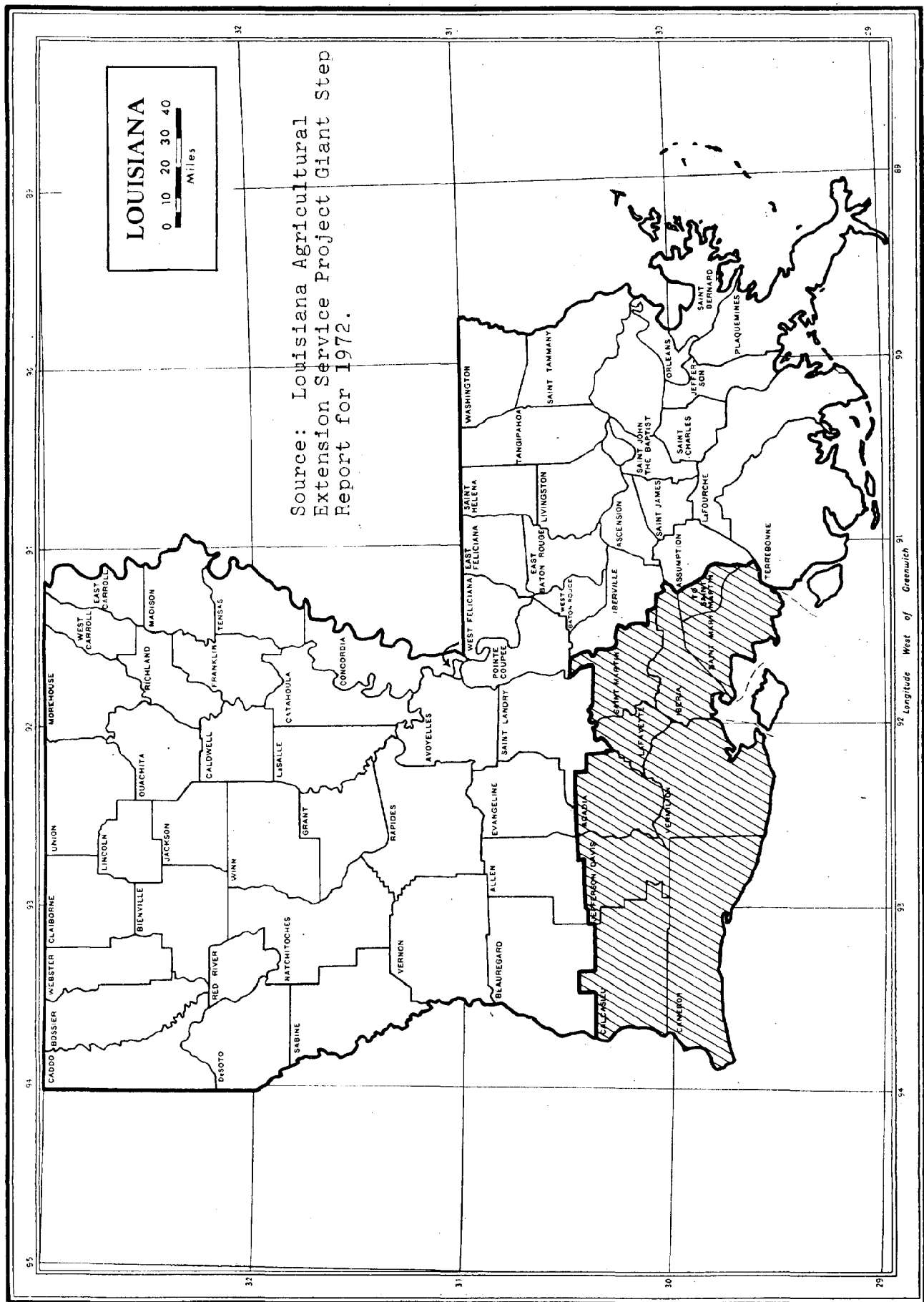


Fig. 2.2 - Rice Production in Louisiana Coastal Zone

RICE PRODUCTION
Table 2.1

<u>Parish</u>	<u>Acreage</u>	<u>Gross Sales</u>
Acadia	93,260	\$21,046,451
Calcasieu	66,880	13,560,856
Cameron	12,550	2,480,194
Iberia	5,913	1,347,572
Jefferson Davis	98,040	22,232,700
Lavayette	10,097	2,237,740
St. Martin	3,993	849,454
St. Mary	3,456	509,032
Vermilion	114,508	25,764,300
<u>TOTAL</u>	408,697	\$90,028,299

July through October.(2) Rice storage and milling industries have developed in conjunction with rice production. The general trend has been to increase operational efficiency by combining drying and milling facilities.(3)

About 429,147 acres were devoted to rice production in 1972. The gross value of the crop was estimated to be in excess of \$91 million.(4) A tabulation of production from each parish (table 2.1) adjoins Fig. 2.2.

3. Soybeans

Soybean production is not limited to a specific area as are the other predominant crops of the Louisiana coastal zone. (Fig. 2.3, Table 2.2). Soybeans have proven a good rotation crop with cotton, rice or sugar cane; (5) they are inexpensive to grow, are salable and are an alternative to other crops which are susceptible to allotment quotas. Soybeans have proved especially compatible with rice farming operations because rice combines can be used to harvest soybeans. Consequently, the crop has gained wide acceptance in a relatively short time.(6)

Soybean, a leguminous crop, has the ability to draw nitrogen from the air and, with the presence of proper bacteria, restore the soil nitrogen content. Soybeans are planted during the late fall or early winter. As days lengthen and soil temperature begins to rise in the spring, the seeds germinate. The crop grows through the summer and is harvested in October and November.(7)

Primary soybean products are oil and meal. One bushel of soybeans produce about 11 pounds of crude soybean oil and about 47 pounds of meal.(8)

Estimated gross value of the 1972 crop in the Louisiana coastal zone was 30.8 million dollars. The Louisiana Agricultural Extension Service also reported that 310,450 acres were devoted to soybean production. (9) It is further anticipated that the current trend of increasing soybean production will continue for some time. A study conducted by the Louisiana State University Agricultural Experimental Station indicated that a substantial number of farmers intend to grow soybeans in the future.(10)

4. Sugar Cane

Sugar cane production is limited generally to that part of the Louisiana coastal zone along the Mississippi

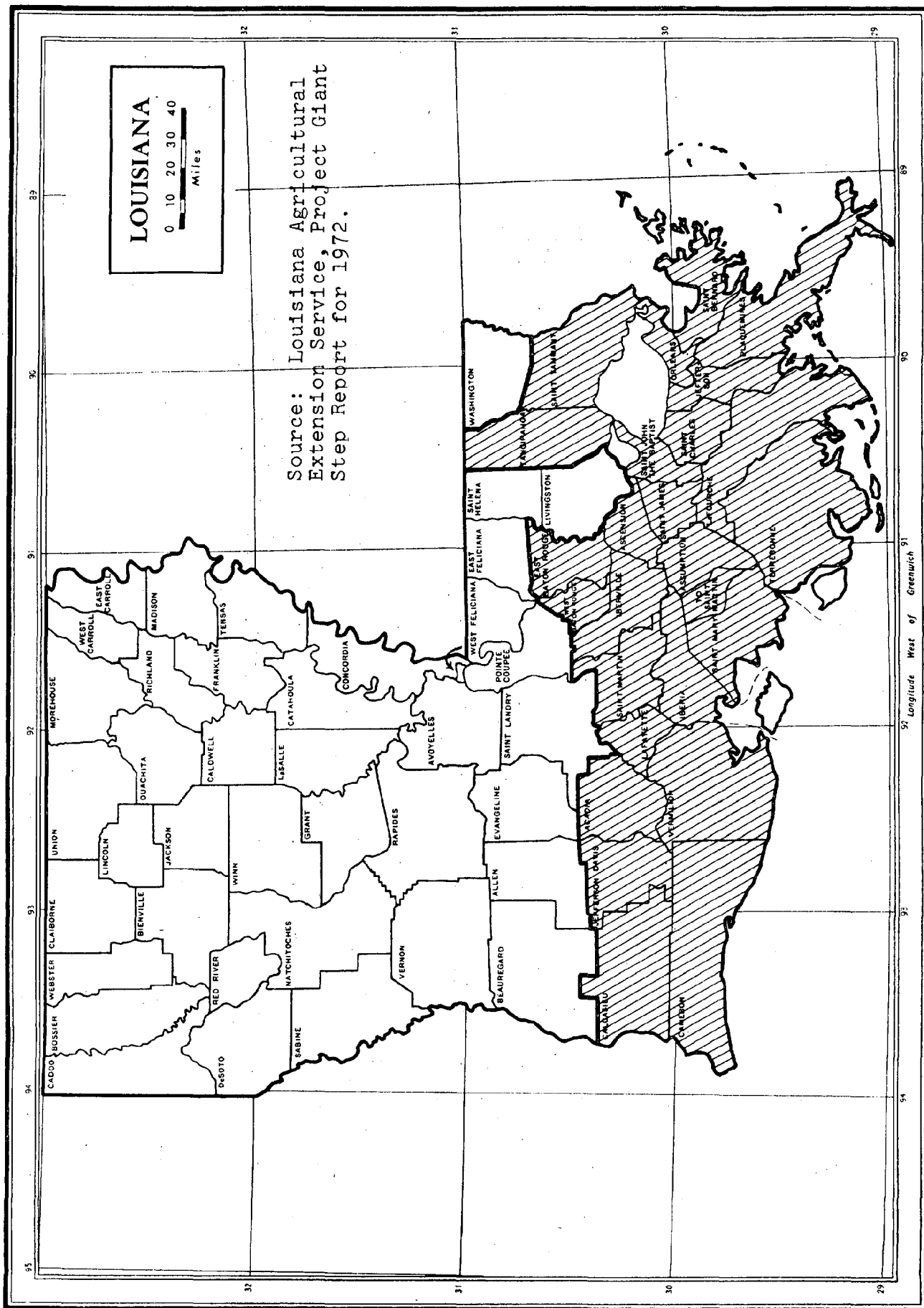


Fig. 2.3 - Soybean Production in Louisiana Coastal Zone

SOYBEAN PRODUCTION
Table 2.2

<u>Parish</u>	<u>Acreage</u>	<u>Gross Sales</u>
Acadia	80,000	\$7,936,000
Ascension	3,500	307,125
Assumption	1,000	110,000
Calcasieu	40,000	3,957,000
Cameron	2,600	198,575
East Baton Rouge	15,000	1,710,000
Iberia	2,800	236,600
Iberville	12,000	1,373,400
Jefferson Davis	90,000	8,910,000
Lafayette	12,200	1,366,400
Lafourche	1,000	99,000
St. James	3,000	294,300
St. John	3,900	442,400
St. Martin	12,000	1,177,200
Tangiboha	3,700	375,069
St. Tammany	750	66,200
Vermilion	25,000	2,025,000
West Baton Rouge	2,000	228,900
<u>TOTAL</u>	310,450	\$30,813,169

and Atchafalaya rivers. (Fig. 2.4) Historically, it is not known where sugar cane was first domesticated. However, there are many wild varieties in India, and that sugar cane was cultivated there in prehistoric times. The great voyages of Vasco De Gama and Christopher Columbus were motivated by the desire of Europeans to discover a safe trade route to India. Sugar was one of the primary articles of trade. The first sugar cane was introduced into Louisiana in 1751 by the Jesuit Fathers with no success. It was not until 1794 that enough was learned about growing sugar cane in Louisiana to produce a commercial crop.

Stalks of the cane containing a series of joints are planted during September and October. Growth begins when the soil temperature is raised by spring sun. The crop grows throughout the summer and is harvested in November and December. Usually two or three crops are grown from a single planting. Sugar is produced from juice squeezed from the stalks, evaporated and refined. There are 44 active sugar mills and refineries in the Louisiana coastal zone.(11)

The Louisiana Agricultural Extension Service reported that 290,102 acres of sugar cane were planted in the Louisiana coastal zone in 1972. The gross sales value of that crop was in excess of \$83.5 million.(12) Production of sugar cane by parish (Table 2.3) adjoins Fig. 2.4.

5. Beef Cattle

The greatest concentration of beef cattle industry in the Louisiana coastal zone occurs in the rice growing parishes. It should be noted that there is a substantial beef cattle industry in most of the other coastal zone parishes. In fact, Louisiana beef cattle industry is among the top ten in the nation.

Because of soil conditions, it is necessary to plant rice crops in rotation. It has also been found that rotation serves to control undesirable weeds on rice land.(13) The net result is that a large portion of land used to produce rice is fallow each year. It has long been the practice to use this land for grazing cattle. Many rice farmers also use part of their land as permanent pasture. This provides supplemental feed when the fallow rice fields do not supply sufficient quality and/or quantity forage and makes it possible to have better quality animals for sale.(14)

SUGAR CANE PRODUCTION
Table 2.3

Ascension	13,500	4,860,000
Assumption	35,000	10,010,000
Iberia	37,167	9,628,917
Iberville	22,025	7,025,925
Lafayette	8,045	1,543,313
Lafourche	38,000	11,172,000
St. Charles	2,703	587,355
St. James	23,691	6,679,665
St. John the Baptist	9,189	2,196,830
St. Martin	20,010	6,051,024
St. Mary	44,000	12,474,000
Terrebonne	21,000	7,056,000
Vermilion	3,487	721,809
West Baton Rouge	12,285	3,611,790
<u>TOTAL</u>	<u>290,102</u>	<u>83,618,628</u>

Basically the Louisiana beef cattle industry raises cattle to the feeder stage; then, they are sold to large feeder lots in western states. This procedure is necessary because it is more economical to ship cattle to the West for fattening than to ship the grain required to fatten the cattle in Louisiana. The state does have a small feeder industry; however, its value is only a small fraction of the overall beef cattle industry.(15)

The Louisiana Agricultural Extension Service reported that 1972 Beef Cattle sales from the Louisiana coastal zone realized about \$35 million (Table 2.4)(16)

6. General

Louisiana has shown a tendency to increase acreage devoted to agriculture. This has been caused primarily by clearing wetlands for soybeans.(17) It has been predicted that, assuming gradual easing of government controls and relatively stable cost-price ratios, about 2 to 2.5 million acres would be used as farm land through about 1980. The coastal zone of Louisiana contains about 10.8 million acres. Of these, about 3.6 million acres are usable for farming.(18)

Beef Cattle Production

<u>Parish</u>	<u>Gross Sales(\$)</u>
Acadia	2,640,000
Ascension	1,464,000
Assumption	160,000
Calcasieu	3,418,800
Cameron	759,375
East Baton Rouge	3,675,000
Iberia	971,250
Iberville	2,100,000
Jefferson	157,500
Jefferson Davis	2,360,000
Lafayette	2,826,250
Lafourche	2,240,000
Livingston	234,000
Plaquemine	50,610
St. Bernard	60,000
St. Charles	420,000
St. James	204,000
St. John the Baptist	112,000
St. Martin	2,400,000
St. Mary	94,000
Tangipahoa	575,190
Terrebonne	1,344,000
St. Tammany	580,000
Vermilion	5,751,000
West Baton Rouge	224,000
Total	34,820,975

Source: Louisiana Agricultural Extension Service, Project Giant
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Table 2.4

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III. Non-Renewable Resources

A. Oil and Gas

The discovery of oil in Louisiana was near Jennings in 1901. By the mid-1930s, drilling barges were being floated into position for drilling on the bottoms of inland waterways. In 1938, drag lines were being mounted on barges to dredge access canals so that submersible drilling barges could be moved into previously inaccessible marsh areas.(1)

Soon afterwards, waterborne pipelaying equipment was used to connect newly drilled wells to ports and processing plants throughout the state. The final step in these developments was completion of the first open-water oil well out of sight of land in the Gulf of Mexico in 1947.(2)

About 19 per cent of the state's total revenue in fiscal 1971-72 was derived directly from oil and gas production in the coastal zone parishes. Almost \$380 million came from severance taxes collected on all oil and gas production and from royalties from production on state-owned land in these parishes.(3) An indication of the involvement of the oil and gas industry in the coastal zone parishes is shown from the following:

--90 per cent of the crude and condensate production in the state came from the coastal zone parishes in 1971.(4)

--93 per cent of the natural and casinghead gas produced in the state came from the coastal zone parishes in 1971.(5)

--89 per cent of oil and gas severance taxes collected in fiscal year 1971-72 was on production in the coastal zone parishes.(6)

--Offshore production of crude and condensate was 47 per cent of the state's total in 1970*.(7)

--Offshore production of natural gas and casinghead gas was 38 per cent of the state's total in 1970*.(8)

*Offshore production figure for 1970 includes zones I through IV.

--South Louisiana accounted for 56 per cent of the wells drilled and 80 per cent of the footage drilled in 1971**.

The Louisiana Employment Security Act covers about 500,000-employees in the coastal zone parishes. In 1971, under this act, mining employees in these parishes were considered to be 7.1 per cent (about 40,000) of the covered work force and were reported to be earning 10.3 per cent of the wages paid to covered employees. On a statewide basis, 93 per cent of the mining employees work with oil and gas production. Omitted from coverage by the Employment Security Act are domestics, governmental employees, workers for nonprofit organizations, self-employed persons, and those working for an employer hiring less than four laborers. (10)

Exploration for oil and gas involves many techniques. Formerly seismic blasting was used almost exclusively to derive records for determining underground structures. Today, other techniques using air guns, vibroseis and sparkers are prevalent. Certain conditions in South Louisiana, e.g. overburden, necessitate that blasting still be used for some exploration, but use of this technique is decreasing. Blasting activities are supervised by the Division of Seafood, Oysters, and Waterbottoms of the Louisiana Wild Life and Fisheries Commission. The effect of controlled seismic blasting has been studied by the Louisiana Wild Life and Fisheries Commission. The conclusion of these studies is that blasting carried out with the proper safeguard has a minimal effect on oysters and other water life. Tests have shown that fish kills do not occur beyond 150 to 200 feet from the blast site.

The majority of oil and gas wells in the coastal zone parishes are in swamp and marsh areas. Canals must be dredged into these areas to float drilling rigs into position. These canals are from 65 to 70 feet wide and 8 feet deep. Access to the rig is necessary during drilling. Later, if the well is a producer, access to the well site is necessary. Thus, these canals usually are not filled or dammed after drilling is completed.

Drilling operations are controlled by permits from the Department of Conservation. These permits control the depth to which casing must be set and the procedures for cementing

**South Louisiana refers to the Department of Conservation zones; thus, 13 parishes not considered by this study to be in the coastal zone are included in these figures.

the well below the casing to protect against blowouts and contamination of nonproducing strata.

To facilitate drilling through mud containing petroleum derivatives are circulated to the drilling bit from the surface. The mud helps to prevent gas blowouts during drilling by maintaining pressure in the well. Use of oil-based drilling muds increases penetration rates as much as 50 per cent but offshore operators generally do not use this oil-based mud because the U.S. Geological Survey prohibits disposal of the mud in the Gulf. The cost of returning the mud to shore for disposal usually would be prohibitive.

Once a well is producing, field development progresses in an almost random manner with respect to surface features. Usually, development of an oil field is influenced strongly by property lines and by information about subsurface features which is obtained as the field is developed. The random drilling pattern with respect to surface features results because property lines and subsurface features usually are not related to surface features.

Natural gas is transported from wells by pipeline. Oil can be extracted from the well and then transported by a liquid carrier, e.g., barge, tank truck, tank car. Location of pipelines for gathering oil and gas and for canals to gather oil by barge usually is influenced by property lines because passage provided by the servitude in most mineral leases may provide the cheapest route to market.

Pipelines can be installed by either the push (or shove) method or the flotation method. For the push method, a narrow ditch about 5 feet wide and 9 feet deep is made by drag line. Marsh buggies are used to support the drag line and to handle the pipe as it is laid. At the beginning of the ditch, the pipeline links are joined together. Then, floats are attached to the pipe and it is floated, or "pushed," down the length of the ditch. When the pipe is in position, it is filled with water and sunk but the ditch is left open or backfilled. Upon completion of backfilling, the spoil that remains from digging the ditch usually has subsided or shrunk so that enough material is not available to fill the ditch. The push method cannot be used unless the marsh is firm enough to support operation of marsh buggies.

Nor can the push method be used for laying large-diameter pipe. In these instances, the flotation method of laying pipe must be used. The flotation method requires dredging a canal 40 to 50 feet wide and 6 to 7 feet deep. A barge is floated down the canal, laying the pipeline behind it. Typically a trench will be dredged in the canal so that the top of the completed pipeline has a clearance 10 to 12 feet below the surface of the marsh.

Generally, spoil from dredging is piled back some distance from the canal. The spoil material which is quite fluid, settles and spreads, sometimes to an area as wide as 85 feet and a depth of three feet. Enough material to refill the canal is never available because of the spreading of the spoil bank and of the irreversible shrinkage of the marsh soil. In some cases, where landowners have required the marsh surface to be restored, dredging material from other sites is necessary to obtain the needed fill.

Operators of pipelines must obtain the consent of landowners whose property the pipeline transverses. These landowners set the conditions for restoration of the marsh surface after the pipeline has been laid. The U.S. Army Corps of Engineers grants permits for all pipeline activity in navigable waterways of the United States. Before granting these permits, the Corps requires a letter of "no objection" from the Louisiana Wild Life and Fisheries Commission, which grants such letters for pipeline activities involving state-owned lands also. The State Mineral Board requires that all its lessees comply with the Louisiana Wild Life and Fisheries Commission regulations and requests. These regulations provide that normal drainage patterns through the marsh areas be maintained. Methods of maintaining these drainage patterns include dams in pipeline canals, cutting continuous spoil banks, and installation of siphons.

The chart below shows the miles of oil pipeline in the state at the beginnings of 1968 and 1971. This chart does not include natural gas pipelines.

<u>Type</u>	<u>Miles of Oil Pipeline*</u>	
	<u>1/1/68</u>	<u>1/1/71</u>
Product	2069	2259
Gathering	2493	2330
Crude	3011	3367
Total	<u>7573</u>	<u>7956</u>

*Mineral Industry Survey, Crude Oil and Refined Products Pipeline, U.S. Dept. of the Interior, Bureau of Mines, Fossil Fuel Division, 1971.

Push-type pipeline installation causes a loss of about one acre per mile of pipeline construction. The flotation method causes an estimated six-acre loss per mile, and dredging access canals for drilling rigs results in an approximate eight-acre loss of marsh per mile. The spoil bank that results from dredging these canals usually is set back from dredging sites because dredge material spreads over a wide base. Thus, it has been estimated that dredging a canal causes area changes 5 to 6 times as wide as the canal itself.(11)

Disposal of waste from oil and gas drilling is controlled by the Department of Conservation. Operators are required to construct dikes around certain installations. In water, swamp, and marsh areas where construction of dikes is problematic, regulations provide that a metal gutter be installed around all permanent tanks to catch all oil or other waste which may be a fire hazard or cause pollution. A sump must be available to catch run-off into the gutter. Regulations of the Department of Conservation also require permission for the disposal of saltwater produced during the production of oil and gas. The preferred method of disposal is considered to be injection into subsurface formations not productive of hydrocarbons. Other outlets for disposal of saltwater include pits and tidally affected waters not fit for agriculture or human consumption.(12)

Before an oil well can be abandoned, permission from the commissioner of conservation must be obtained. A plan of abandonment requires that substantial cement plugs be placed in the well to prevent commingling of oil, gas, saltwater and freshwater.(13)

Production of oil and gas from offshore regions is centered around oil and gas platforms, which are constructed onshore and floated into place. The platforms are submerged onto pilings that have been driven into the ocean floor. An estimated 4,000 miles of pipelines service offshore wells in state and federal zones.(14)

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B. Minerals (Excluding Oil and Gas)

Production of sulfur, salt, salt brine, sand and shell are considered in this section. Except for 43 per cent of the sand output, their production in Louisiana comes from the coastal zone parishes. Table 2.5 shows production information of these minerals and state revenue from severance taxes on this production.

In addition to the severance taxes collected by the Department of Revenue, the Louisiana Wild Life and Fisheries Commission collects royalties on dredging of shell from state waters. These royalties amounted to about \$1.9 million in fiscal 1971-72.(1) Total royalties and severance taxes amount to 2.7 per cent of the state's total revenue.(2)

Available labor statistics are not broken down by each of these industries, but a general picture can be obtained from statewide figures. Because employees in these industries are classified by the Employment Security Act as working in nonmetallic quarrying, they are grouped with the 7 per cent of the mining employees not working in oil and gas production. In 1971, the average weekly wage of these non-metallic quarrying employees was 14 per cent less than that of oil and gas production workers.

1. Sulfur

The Frasch process for producing sulfur was perfected in the early 1900s. Its success inaugurated the commercial sulfur industry in Louisiana. In 1969, sulfur production reached a peak in Louisiana. Since then, production has decreased and sulfur prices have dropped as much as one third. In fiscal 1971-72, sulfur was produced in four parishes--Calcasieu, Lafourche, Plaquemines and Terrebonne.

In most cases, sulfur is stored in liquid form by producers and their industrial consumers. Usually, it is transported as molten liquid by rail and barge. Initially, about 90 per cent of all sulfur is converted into sulfuric acid. Ultimately, about 50 per cent of it is used in fertilizer manufacture, and 20 per cent in the chemical process industry.(3)

In Louisiana, commercial quantities of sulfur are found under the cap rock of about 10 per cent of the state's salt domes. All the sulfur produced in the state is

MINERAL FACTS*

Mineral	1970 Value of Production	1970 Quantity of Production	Severance tax 1971-72 Collection	Production Basis of Severance Tax
Sulfur	\$89.4	3.6 long tons**	\$2.46	2.4 long tons**
Salt (total)	64.8	13.6 short tons	.43	14.9 short tons
--Brine	24.5	7.7 short tons	.04	8.4 short tons
--Evap.	2.9	0.3 short tons		
--Rock	32.4	5.6 short tons	.39	6.5 short tons
Shell (total) (5)	18.0	10.4 cu. yds.	.38	9.4 short tons (11.5 cu.yds.)
--Oyster		5.8 cu. yds.		
--Clam		4.6 cu. yds.		
Sand	8.2	7.5 short tons	.28	9.3 short tons

*(statewide figures, all figures are in millions)

**Discrepancy due to setting offshore state boundaries. Sulfur production remained almost constant during this period.

Table 2.5

Source: Louisiana Department of Revenue
and U.S. Department of the Interior

recovered by the Frasch process. Recovering sulfur by the Frasch process requires injecting large quantities of super-heated water in the sulfur strata to melt the sulfur. The molten sulfur is forced part of the way to the surface by pressure within the strata. Compressed air is used to lift the sulfur the rest of the way to the surface.

The quantity of sulfur removed is much smaller than the quantity of hot water that must be injected to melt the sulfur. Because the sulfur-bearing strata are sandwiched between two strata, through which water cannot pass, continued water injection can cause a built up in pressure in the sulfur, making further water injection impossible. Preventing this pressure buildup requires removing bleed water through a well drilled into a low point in the sulfur strata. At some Frasch process mines, bleed water amounts to as much as five million gallons of water a day.(4)

Except for a large content of hydrogen sulfide and the absence of dissolved oxygen, bleed water is chemically similar to sea water. Hydrogen sulfide can be removed from bleed water by allowing the hydrogen sulfide to diffuse into the atmosphere, or by mixing the bleed water with sea water containing dissolved oxygen, which converts hydrogen sulfide into elemental sulfur. Usually, a combination of these processes is used to remove the hydrogen sulfide. Then, the water is allowed to flow through a retention pond where part of the remaining hydrogen sulfide diffuses into the atmosphere. (Sulfur bacteria in this pond aid the conversion to elemental sulfur). Finally, the bleed water is mixed with a sea of brackish water into which the bleed water is exhausted. This final step converts any remaining hydrogen sulfide into elemental sulfur. In some offshore installations, hydrogen sulfide is removed from bleed water by direct mixing with sea water. It is reported that, at these installations, routine samplings at points 500 feet from the well discharge show either trace or zero quantities of hydrogen sulfide remaining in the water.(5)

2. Salt

In Louisiana, salt is produced as a solid and as a brine solution. The solid is produced from inside salt domes by room and pillar mining operation, and the salt brine is produced similarly to the Frasch process for recovery of sulfur. In fiscal 1971-72 about 56 per cent of the salt was produced in the form of a brine solution. In that period, salt was produced as a solid in three parishes and as a brine solution in eight parishes. Most of the salt produced in Louisiana is used as chemical feed stock.

3. Shell Dredging

The shell dredging industry in Louisiana was started under the auspices of the Conservation Commission in 1913. Today, these activities are controlled by the Louisiana Wild Life and Fisheries Commission, which grants leases for shell dredging rights. Annual production of oyster shells and clam shells is approximately the same.(6) Shells are used in road construction, lime and cement manufacture, chemical production and poultry feed. Shell dredging near beds of actively cultivated oysters is prohibited by the Louisiana Wild Life and Fisheries Commission.

4. Sand

Within the state, sand is produced from dredging and stationary mining operations. The largest part of the sand is recovered from water bottoms of active or bypassed water courses. About 45 per cent of the sand produced in the coastal zone parishes comes from five parishes bordering on Lake Pontchartrain. The major consumption of sand is in the urban and suburban areas of the suburban areas of the state.(7)

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IV. ACTIVITIES

A. Refining and Manufacturing

Manufacturing industries are discussed in this section. Classification of these industries includes such dissimilar operations as oil refining, sugarcane refining, shipbuilding, apparel manufacturing and seafood packing. Statistics on these industries are not generally available on a parish basis because such information would divulge the activities of individual companies. Accordingly, this discussion largely contains statewide figures. However, it can be said that these industries are based largely in the coastal zone parishes because:

--The largest single manufacturing employer in the state, a shipyard, is located in the coastal zone.(1)

--Food processing, the manufacturing industry with the largest number of employes, is predominately based in the coastal zone parishes. Food processing includes seafood packing, rice milling, and sugar processing.

--From 1946 to 1971, 78.7 per cent of new investment in manufacturing facilities in Louisiana was in the coastal zone parishes.(2)

--In 1971, 65 per cent of the state's manufacturing jobs in the coastal zone parishes.(3)

Following is Table 2.6, which indicates facts about the most important manufacturing industries in the state. One of the terms in this chart, "value added by manufacturer," expressed the material's value increase (a result of the process) and is considered a good indication for use in comparing manufacturing industries.(4)

1. Employment and Wages

In 1971, 65 per cent of the state's manufacturing employes worked in the coastal zone parishes. They earned 70 per cent of the wages paid to manufacturing employes, and their average weekly salary was \$172.00. That same year, the nine parishes with the highest average weekly manufacturing wages were in the coastal zone. The total number

STATISTICAL COMPARISON OF MANUFACTURING INDUSTRIES IN 1971

Industry	Total No. Of Employees (Thousands)	Production Employees (Thousands)	Total Payroll (Millions)	Value Added (Millions)	Capital Expenditure (Millions)
Chemical	22.2	15.6	249.0	1,011.1	207.3
Food	29.8	19.3	190.6	573.4	35.3
Paper	15.0	12.4	142.8	341.5	24.4
Petroleum	10.0	6.2	125.6	413.9	206.3
Transportation	17.6	15.4	150.2	198.1	5.1
All Other	66.4	50.5	489.8	966.5	536.5

Table 2.6

Source: U.S. Department of Commerce,
Bureau of Census County Business Patterns

of employees working in manufacturing in the state decreased by 1,300 from 1970 to 1971 but the decrease was less than 100 employees in the coastal zone parishes.

2. Industry Description

The following description of the more important industries in the coastal zone parishes by the Louisiana Department of Commerce and Industry was presented in a report to the Commission in February 1972:(5)

"Industry in the coastal region is dominated by petroleum refining, petrochemical production, ship and boat building, food processing and primary metals. Apparel making, metal fabrication and pulp and papermaking are also important industries."

"Petroleum refining and petrochemicals are by far the largest. More than \$5 billion has been invested in these industries in the coastal region since World War II and most of the 32,000 plus workers employed in these industries work in the coastal parishes."

"There are approximately 100 major petroleum and petrochemical plants in Louisiana making the state one of the principal producers in the United States. A number of the facilities are among the largest of their kind in the world. Over the last 10 years Louisiana has attracted about 10 per cent of all new investment in chemical and petroleum refining expenditures in this country."

"Ship and boat building continue to be a mainstay in the state's industrial economy. A shipyard is the single largest employer in Louisiana, with a work force ranging upward to 10,000 at times." The Avondale yards and other smaller yards specialize in supplying the needs of the off-shore industry--drilling platforms, tugs, barges, crewboats, and other specialized vessels are constructed in Louisiana. Boats for commercial fishing and pleasure use are built in small yards scattered across the coastal region.(6)

"Food processing, including seafood processing, is a major industry in the coastal parishes. An estimated 21,000 workers are employed in processing and packaging of shellfish, sugarcane products, sweet potatoes, special condiments, candies and general agricultural products. And of course, the existence of such plants plays an important role in the area's farm economy inasmuch as they provide ready markets for farm produce."

"Two of the largest apparel manufacturing operations of their kind in the world are located in the New Orleans area of the coastal region. And, indeed, until recently, New Orleans was the center of apparel manufacturing in the state. In recent years, however, the industry has spread to south central Louisiana and a plant scheduled to hire a thousand workers will open in St. Martin parish shortly."

"The second largest primary aluminum production plant in the U.S. is located in the coastal region below New Orleans. Another such plant is located near Lake Charles. Louisiana is also the largest producer of alumina, the fine white powder from which aluminum is made, and we are the largest importer of bauxite for the U.S."

3. Why Industry Locates in Louisiana

An examination of the manufacturing industry in Louisiana would be incomplete without an indication of the reasons for industrial growth in Louisiana. The Public Affairs Research Council conducted surveys in 1962 and 1969 to determine industry's reasons for locating in Louisiana.(7) According to these surveys, industry gave the following ranking of what is considered Louisiana's most important attractions:

1962	1969
1. Proximity to raw materials	1. Proximity to raw materials
2. Water for industrial use	2. Proximity to markets
3. Water transportation	3. Supply of labor
4. Industrial tax exemption	4. Availability of sites
5. Cost of fuel	5. Industrial tax exemption
6. Cost of transportation	6. Cost of labor
7. Cost of power	7. Water transportation
8. Proximity to markets	8. Water for industrial use
9. Availability of sites	9. Cost of raw materials
10. Supply of labor	10. Cost of fuel

Many of the factors industry considers to be most important such as availability of natural gas (fuel), availability of crude petroleum (raw materials) and water for transportation and industrial use are abundant in the coastal parishes.

According to statistics of the Department of Commerce and Industry(8) in 1972, \$716 million were spent on new facilities in the coastal zone parishes, creating an

estimated 2,631 new jobs. This was only 39 per cent of the investment for industrial facilities in the state that year. However, if investments for atomic power plants were excluded (such power facilities are not considered manufacturing industries), then 86 per cent of the manufacturing investment in the state would have been in the coastal parishes in 1972. Of note is the fact that 33 per cent of the total industrial investment in 1972 was in the parishes bordering on the Mississippi River.

4. Control of Industrial Pollution

Discharge of industrial waste to streams or to the atmosphere is subject to control by the Louisiana Stream Control Commission and the Louisiana Air Control Commission respectively. Both agencies have the power to issue cease and desist orders and to enter industrial property for inspection.(9) The general practice of these agencies is to require permits for all discharges from industrial sources.

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B. Ports and Water Transportation

Louisiana always has derived considerable income from water transportation. Since the early days of national history, the port of New Orleans has served as a link between the central interior of the nation and the sea. New Orleans is now, as it has been in the past, one of the great ports of the world. Among United States ports, New Orleans is second only to New York in tonnage handled and is the largest port on the Gulf of Mexico.(1) In 1972, crude petroleum was the largest single item moved through the Port of New Orleans. Grain and grain mill products accounted for more than one-third of the port's shipments in 1972. Corn leads all the commodities in export figures; while sugar was the largest import item.

Upstream from New Orleans on the Mississippi River is the port of Baton Rouge, third among the Gulf ports in tonnage handled and sixth-ranked nationally in this category.(2) Bulk cargoes, petroleum and petroleum products, grains, and ores give Baton Rouge its high ranking among the United States ports, but considerable general cargo flows through the port.

Lake Charles, the state's third deep water port is ranked ninth in tonnage among the Gulf ports and nineteenth in the nation.(3) In total shipping, Louisiana ports accounted for more than 12 per cent of the United States total in 1971. Table 2.7 shows tonnage passed through the state's major ports in 1971 and 1970.

Gasoline, at 5.5 million short tons (2,000 lbs.), was the largest item in 1971 Baton Rouge port data. Other tonnages in 1971 were: basic chemicals, 4.6 million tons; aluminum ore and concentrates, 4.3 million tons; crude petroleum, 4.2 million tons; corn, 2.3 million tons; and soybeans, 2.1 million tons. In 1972 the largest commodity moved through the Port of Baton Rouge was basic chemicals. Crude petroleum was the largest single item moved through the port of Lake Charles in 1971.(4)(5) Lake Charles has large bulk cargo operations consisting primarily of petroleum and its derivatives in addition to moderate amounts of general cargo.(6)

Aside from deep-draft ocean shipping, Louisiana is a key focal point for inland waterway traffic. Inland barge traffic not only links the deep water ports to the interior of the nation but also provides important support for the industrial structure of coastal Louisiana.(7) The major

COMMERCE IN LOUISIANA'S THREE LARGEST PORTS
IN 1971 AND 1970
(in thousand tons of 2,000 pounds)

Port	Total	Foreign		Domestic						Local
		Imports	Exports	Coastwise		Barge		Shipmts.		
				Receipts	Shipmts.	Receipts	Shipmts.			
<u>1972</u>										
Baton Rouge	52,903	8,300	7,700	893	8,400	9,700	17,400	317		
Lake Charles	17,029	581	1,300	70	3,100	7,700	3,600	548		
New Orleans	125,719	8,100	28,800	2,300	18,000	41,000	23,800	3,300		
<u>1971</u>										
Baton Rouge	47,017	7,715	5,966	720	8,347	8,384	15,538	347		
Lake Charles	19,218	359	1,362	43	4,777	8,365	3,920	392		
New Orleans	120,067	8,796	21,608	2,310	27,496	33,012	24,576	2,269		
<u>1970</u>										
Baton Rouge	45,535	7,211	6,763	762	8,787	7,902	13,903	208		
Lake Charles	17,676	193	1,692	32	3,386	8,580	3,568	225		
New Orleans	123,674	7,535	24,680	1,966	29,441	34,143	23,676	2,233		

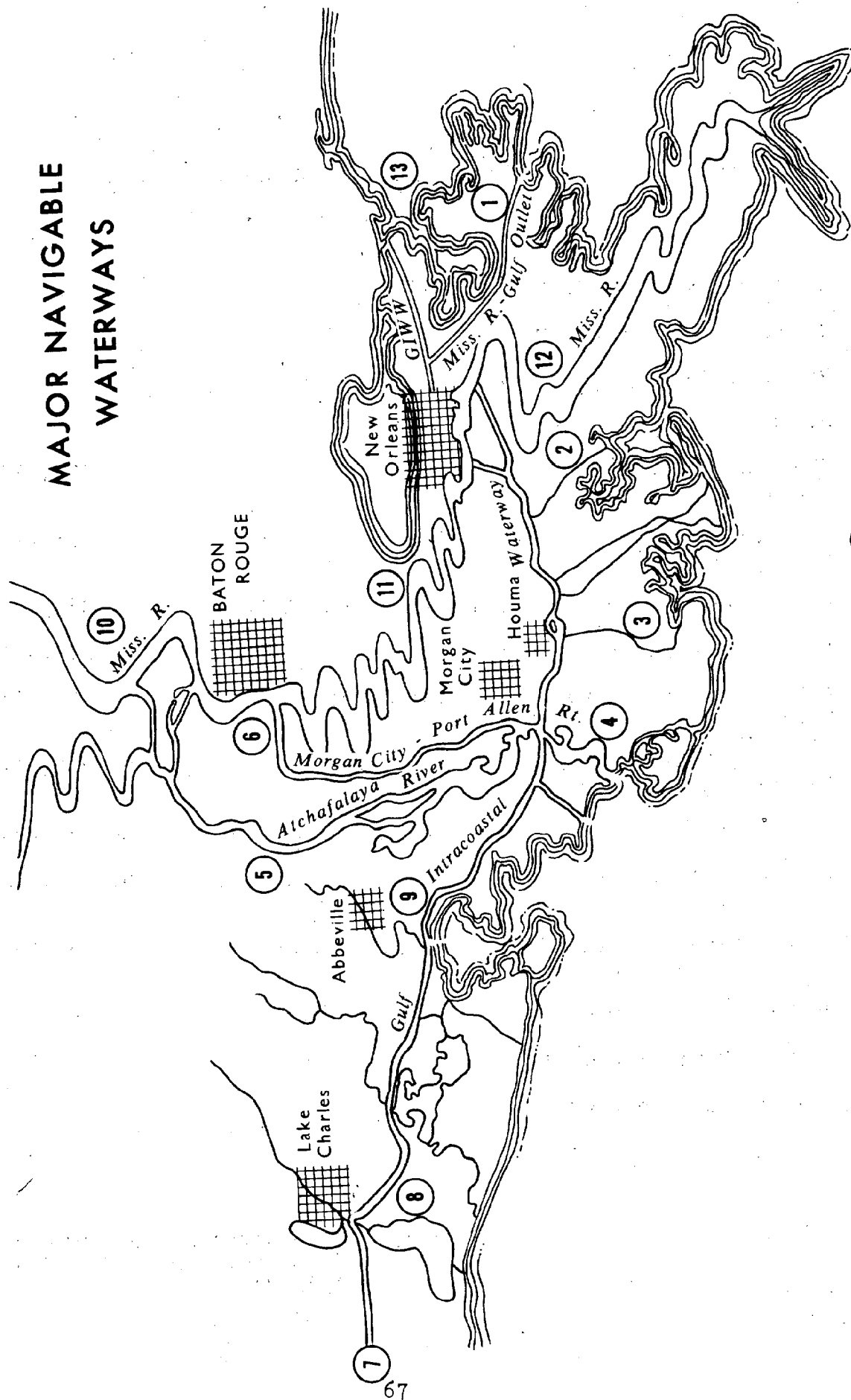
Table 2.7

Source: Waterborne Commerce of the United States, National Summaries, U.S. Army Corps of Engineers for 1970 and 1971.

navigable waterways in the state (Fig. 2.5) are the Gulf Intracoastal Waterway (GIWW) and the Mississippi River. Shipments over the GIWW between the Mississippi and Sabine rivers are almost four times as great as shipments over the GIWW between Mobile Bay and New Orleans. A major spur of the GIWW, the Morgan City-Port Allen Route is entirely within the Coastal Zone and carries tonnage about as great as that on the Mobile Bay-New Orleans section of the GIWW. The Amount of freight transported on the Mississippi between Baton Rouge and New Orleans is almost twice as great as the amount transported on the GIWW between the Mississippi and Sabine rivers.(8) Traffic from New Orleans to Mouth of Passes is 18.5 per cent larger than traffic between Baton Rouge and New Orleans.

Barge traffic is especially important to the petroleum and chemical industries in Louisiana because it not only supplements pipelines to a considerable extent but also provides low-cost movement of refined petroleum and chemicals to the interior of the nation and to the deep-water ports for trans-shipment. Barge service as a stimulus for industrial locations along waterway routes is evidenced by the concentration of petrochemical facilities adjacent to water sites in Louisiana.(9)

According to data of the Louisiana Department of Employment Security, the average weekly wage of employees of the water transportation industry in Louisiana was \$160.00 in 1971. Table 2.9 shows employment in taxable payrolls for several facets of the water transportation industry in Louisiana in 1969 and 1971.



GULF OF MEXICO

Fig. 2.5 - See Table 2.8 for tonnage data.

KEY TO TONNAGE TRANSPORTED OVER MAJOR NAVIGABLE WATERWAYS

(All figures in short tons)

1. Mississippi River Gulf Outlet	3,982,015
2. Barataria Bay Waterway	5,432,540
3. Houma Navigation Canal	3,262,604
4. Atchafalaya River - Morgan City to Gulf	4,093,883
5. Atchafalaya River - Old River Lake to Morgan City	7,934,624
6. Gulf Intercoastal Waterway - Morgan City to Port Allen	14,368,939
7. Lake Charles Deepwater Canal to Sabine River	41,380,133
8. Calcasieu River to Gulf	19,218,439
9. Gulf Intercoastal Waterway - Mississippi River to Sabine River	70,563,298
10. Mississippi River - Mouth of Ohio River to Baton Rouge	90,323,619
11. Mississippi River - Baton Rouge to New Orleans	136,685,284
12. Mississippi River - New Orleans to Mouth of Bassar	162,168,551
13. Gulf Intercoastal Waterway - Mobile Bay to New Orleans	18,660,228
Port of New Orleans	120,066,944
Port of Baton Rouge	47,016,527
Port of Lake Charles	19,218,439

Table 2.8

Source: Waterborne Commerce of the U.S. Army Corps of Engineers 1971-72.

Water Transportation Employment, Payrolls, and

Number of Reporting Units 1969, 1971

	Number of Employees		Taxable Payroll		Total	
	1969	1971	Jan.-March (\$1,000)	1971	1969	1971
Water Transportation	18,536	22,515	25,605	32,480	887	934
-Deep Sea Foreign Transportation	878	554	731	1,540	9	13
-Transportation on Rivers and Canals	1,099	921	2,236	1,963	18	18
-Local Water Transportation	8,568	9,444	13,123	15,978	711	741
-Water Transportation Services	7,988	11,593	9,510	12,993	147	159
--Marine Cargo Handling	6,725	10,388	7,677	11,029	46	57
--Water Transportation Service		1,198		1,953	100	100

Table 2.9

Source: U.S. Department of Commerce,
Bureau of Census, 1969 and 1971.

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C. Urban Settlement in Louisiana's Coastal Zone

1. Historical

Early settlers in south Louisiana were much influenced in their choice of sites to inhabit by the surface features of the area. They built upon the higher natural levees of rivers and bayous because the natural levees were fertile, relatively free from floods, and the waterway provided transportation access. The pattern of linear settlement along waterways can be seen throughout south Louisiana today.

Until the 1850s, there was no large city, other than New Orleans, in Louisiana; the remaining 700,000 inhabitants of the state lived in the rural areas or small towns. Settlement patterns began to change with the advent of railroads, which provided access to Louisiana's western grassy prairies for immigrants from the midwestern plains of the United States. Until the introduction of modern highways provided access to market, the plantation system boomed in the rich lands of the south, while the northern portion of the state maintained small subsistence farms. Afterwards, these were replaced by large agricultural operations.

"During the past hundred years the face of Louisiana has been transformed by technical and economic developments and by growth and shifts of population; of chief geographical importance are the emergence of means of transportation, control of the Mississippi, settlement of the prairies, petroleum production, shifts in agricultural emphasis, industrialization, and the growth of cities."(1)

Currently, Louisiana contains about 3.8 million people, 2.45 million of them in the coastal zone.(2) Projections (Fig. 2.6) indicate that over the next 15 years the population of the coastal zone will increase 24 per cent, compared to a 3 per cent decline in population for the remainder of the state.

2. Major Cities in the Coastal Zone

a. New Orleans

"New Orleans is Louisiana's largest city (1970 standard Metropolitan Statistical Area population as defined by the U.S. Census: 1,045,809) and is located on the banks of the Mississippi River and Lake Pontchartrain. Its first settler, Bienville, chose the site in 1717 because it was the highest ground in the vicinity and offered a strategic location for control of the entire Mississippi River

drainage basin. At that time, Bienville's engineer advised against the location, because the city would be continually flooded by the river."(3) Bienville overruled his engineer and New Orleans was constructed on the natural levee of the Mississippi River.

New Orleans is the leading port of the Gulf coast. Because the city is flanked by Lake Pontchartrain on one side and the Mississippi River on the other, the growth patterns of New Orleans have assumed a linear contour extending primarily east and west.(4)

Most of the heavy industry of New Orleans involves shipping, chemical industries in Chalmette and food processing plants. "The tourist industry is the second largest employer in the area and is vital to the economy of New Orleans, (5) because of the cultural atmosphere of the city. "Most significantly, the New Orleans metropolitan area contains nearly 29 per cent of the State's total population. This distribution has not changed radically since the 1930 census, even though a major rural/urban shift has occurred."(6)

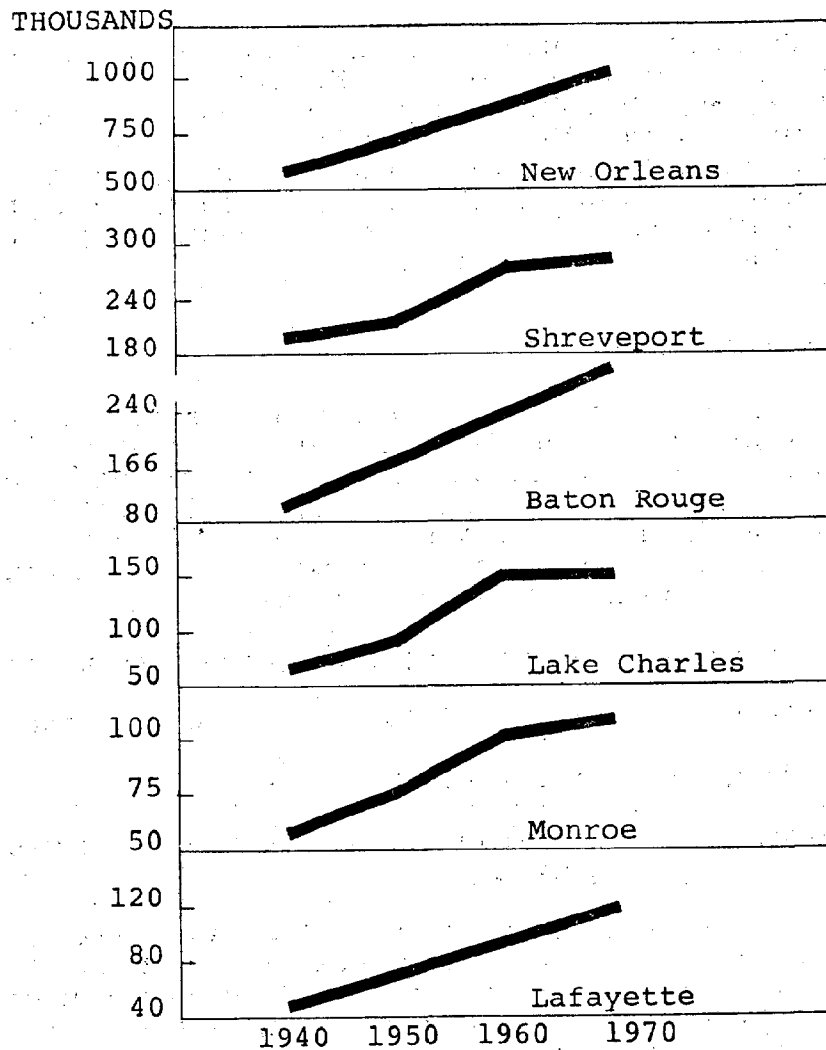
b. Baton Rouge

Baton Rouge was settled as the first high ground up the Mississippi River from the Gulf of Mexico. "Today, Baton Rouge is an education and industrial center, with Louisiana State University and the refinement of oil and gas as its principal activities. It is also the location of the state government, another major employer in the city. In addition, the city is the third ranking port on the Gulf Coast, surpassed only by New Orleans and Houston. The location of these activities has led to an unusual growth pattern. Location of industry along the river formed a linear pattern from north to south."(7)

c. Lafayette

"Lafayette was established around a large Roman Catholic church at the head of the navigable Vermilion Bayou and the intersection of a road linking Texas and Florida. Its early economy was based on trade, for which it was well sited. About 1880, a railroad was linked to the town and it became the established center for trade of cotton, sugar, rice, and other commodities. In the past 25 years, however, Lafayette has boomed because of the discovery of oil in the vicinity, and many oil companies have established offices in the city."

POPULATION OF MAJOR METROPOLITAN
AREAS, 1940-70



LOUISIANA STATE POPULATION GROWTH PROJECTIONS

CATEGORY	1950	1960	1970	1980	2000	2020
Urban	1,851,268	2,357,320	2,618,778	3,152,027	4,215,059	5,565,873
SMSA	1,309,406	1,750,456	1,996,197	2,456,587	3,387,049	4,560,863
Non-SMSA	541,862	606,864	662,581	695,440	828,010	1,005,010
Rural -- Non-SMSA	832,248	899,702	1,022,528	1,133,992	1,339,431	1,621,110
State Total	2,683,516	3,257,022	3,641,306	4,286,019	5,554,490	7,186,983
Percent Change	13.5	21.4	11.7	17.7	29.5	22.7
Annual Change	1.450	2.130	1.170	1.770	1.475	1.135

Fig. 2.6

Source: Gulf South Research Institute: Comprehensive Water and Related Land Resource Study -- Economic Appendix 1970-2020, May 1972.

d. Lake Charles

"Lake Charles, Lafayette's older neighbor to the west, also started as a commerce center, with an emphasis on timber and export. The discovery of oil, gas, and sulfur hit Lake Charles about the turn of the century. The city is located on relatively high ground on a wide lake in the Calcasieu River. Access to the Gulf is readily available through Calcasieu Pass, which facilitates shrimping and access to offshore oil facilities."(8)

3. Urban Patterns

"Major metropolitan areas contain 55 per cent of the state's population. . . in 1940 the parishes that now compose the six largest metropolitan areas accounted for only 43 per cent of the population. By 1960, more than half of the population was living in the six largest cities The New Orleans metropolitan area accounts for nearly 30 per cent of the state total."(9)

Growth rates of the four major cities are shown below:

New Orleans. . .	increased 15 per cent during the 1960s
Baton Rouge . .	increased 24 per cent
Lake Charles . .	no growth
Lafayette . . .	increased 30 per cent, the fastest growth

These figures express percentage increase only. Existing physical space, size of population, and the location of the city with respect to the surrounding environment must be considered to evaluate properly the impact of growth. A 15 per cent increase in a very large city like New Orleans may seem significant in contrast to a 45 per cent increase in the case of a smaller urban area, but the increase in the number of people may be greater.

"In addition to population growth, the State has also experienced a shift in population from rural to more urban environments, the results of technological change in agricultural productivity. A proportion of the rural population also left the State entirely. Most of this migration, inter- and intra-state, occurred between 1920 and 1950. While the rural population continues to decline as a per cent of the total State population, the actual number of people living in rural places has increased in the last decade."(10)

Generally, growth in population has continued an old trend of expansion in the southern and, in particular, the southeastern portion of the State.(11)

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D. Transportation

1. Highways

The principal through highways in Louisiana are shown in Fig. 2.7, and the primary traffic routes through the Louisiana coastal zone are shown in Fig. 2.8. Travel in the western and central sections of the coastal zone is almost exclusively in an east-west direction, but there is substantial north-south traffic from the New Orleans area, where Interstate 55 and 59 are available. A tabulation of typical daily use (cars per day) is included in Table 2.10. Generally, the traffic load on major routes exceeds 6,000 cars per day and in some of the more heavily traveled legs of the route, e.g., between Opelousas and Baton Rouge, or between Baton Rouge and New Orleans, traffic exceeds 13,000 cars per day.(1) (Table 2.10).

In the coastal zone, Louisiana maintains more than 6,000 miles of nonrural roadway, comprising four types of road.(2) Table 2.11 shows each of the road types, its percentage of the total mileage in the coastal zone, and the percentage which the coastal zone figure represents statewide. For example, asphalt roads constitute 80 per cent of the total miles of roadway in the coastal zone, and that amount is 43 per cent of the total miles of asphalt roads in the state. In other words, 43 per cent of the asphalt roads in Louisiana are in the coastal zone and 57 per cent are outside it.

The coastal zone of Louisiana also has more than 7,000 miles of local rural roads. This mileage does not include city streets or city extensions of local roads which, if included, would increase the mileage considerably.(3)

The area along the coast generally has suffered from a lack of feeder roads. This is traceable to the fact that soil conditions in the area make road construction costly.

2. Railroads

In 1970, there were more than 4,300 miles of main line, Class I, track in Louisiana.(4) Fig. 2.9 presents an outline of this system.(5)

The primary east-west line in the coastal parishes is Southern Pacific, which runs from New Orleans westward to

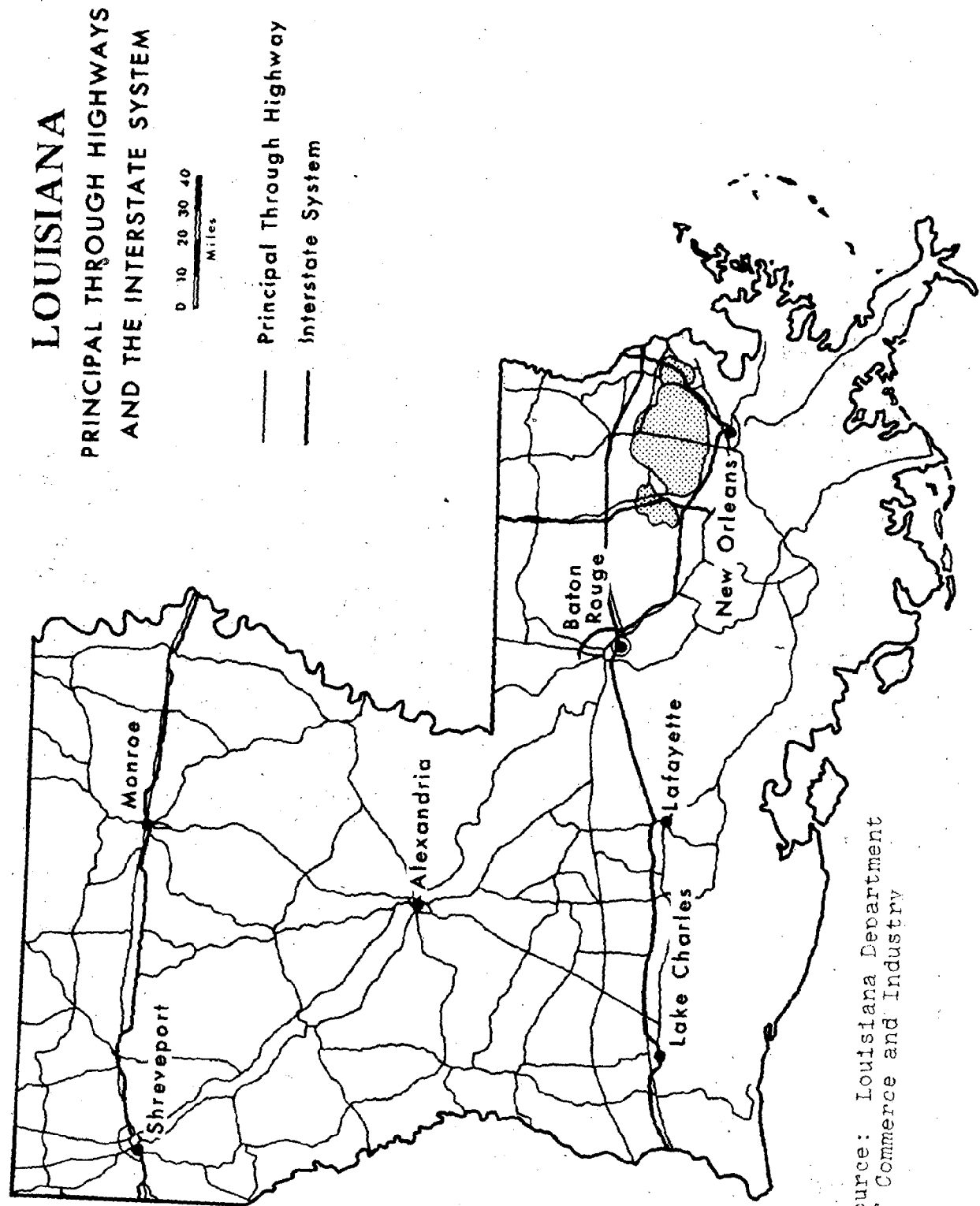
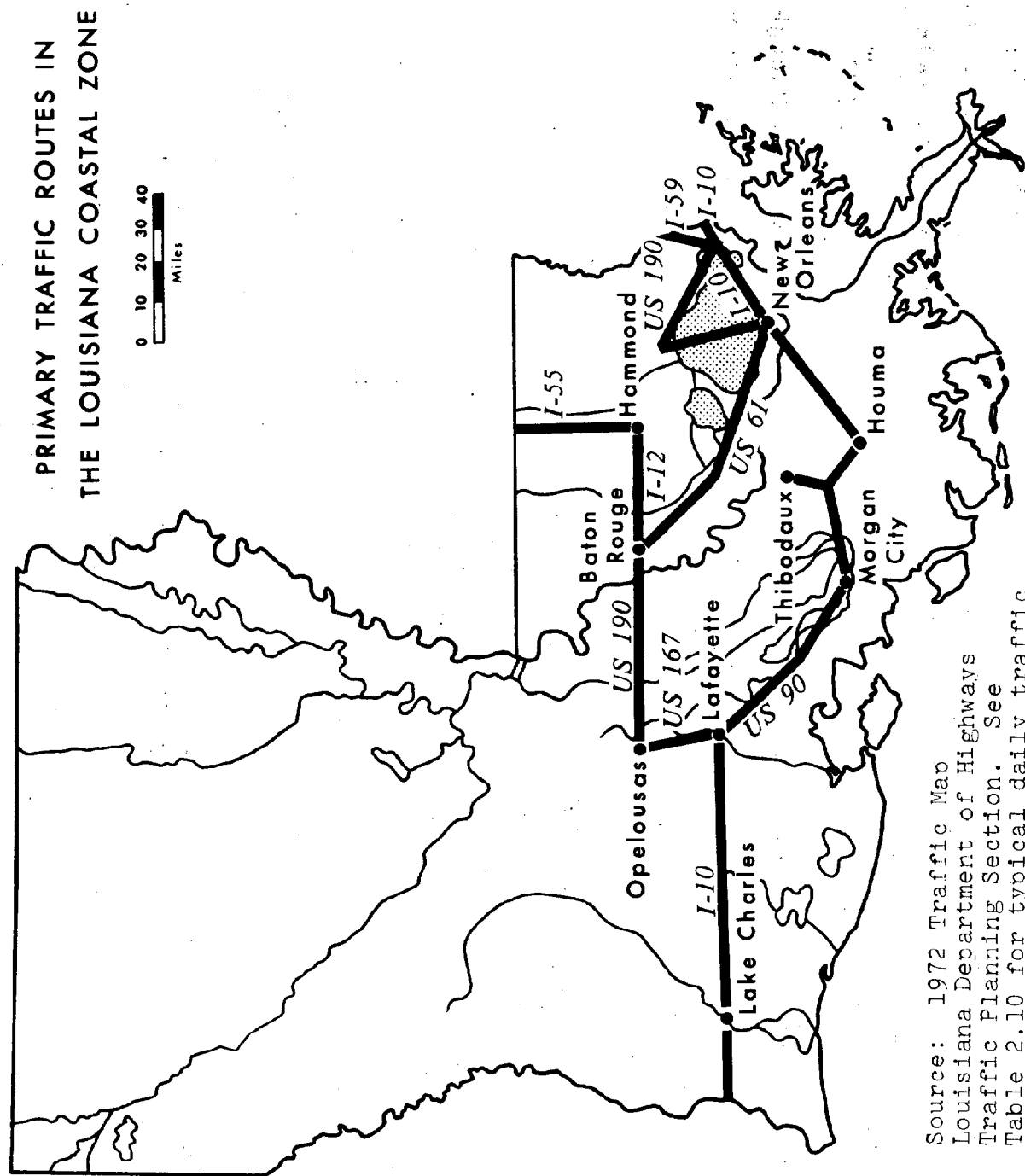


Fig. 2.7 Source: Louisiana Department of Commerce and Industry



Source: 1972 Traffic Map
Louisiana Department of Highways
Traffic Planning Section. See
Table 2.10 for typical daily traffic
load.

Fig. 2.8

LOUISIANA

RAIL-COMMON CARRIERS

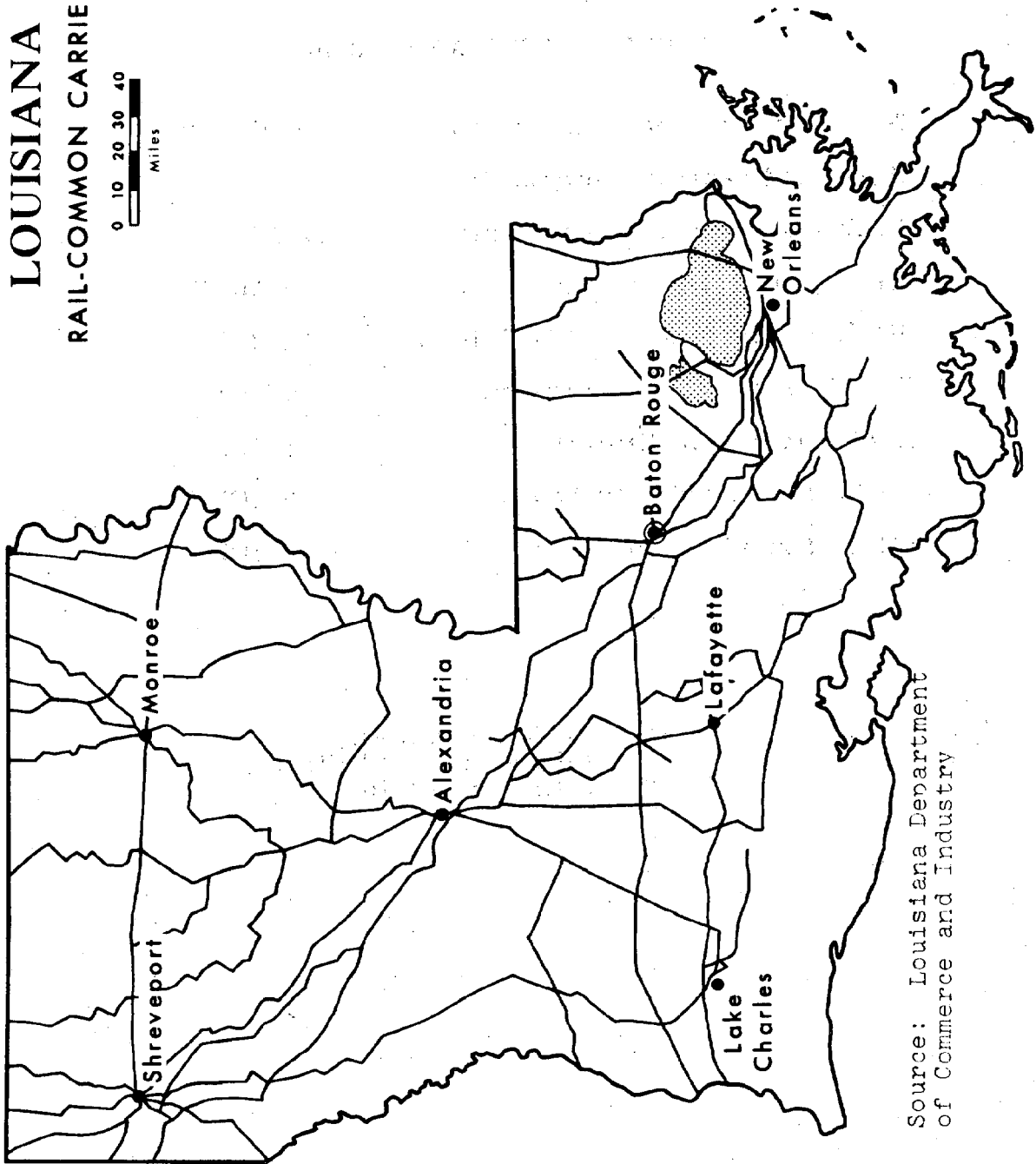


Fig. 2.9 Source: Louisiana Department of Commerce and Industry

TYPICAL DAILY TRAFFIC LOAD

I-10 Lake Charles to Lafayette	9,000 cars
US 90 Lafayette to Morgan City	6,000 "
US 167 Lafayette to Opelousas	16,000 "
US 190 Opelousas to Baton Rouge	13,000 "
US 61 Baton Rouge to New Orleans	13,000 "
I-12 Baton Rouge to Hammond	7,000 "
I-55 North from Hammond	5,500 "
US 90 Morgan City to Houma	9,500 "
US 90 Houma to New Orleans	11,500 "

Table 2.10

Source: 1972 Traffic Map
Louisiana Department of Highways
Traffic Planning Section.

<u>Type of Road</u>	<u>Percentage of Mileage In Coastal Zone</u>	<u>Miles</u>	<u>Percentage Which Coastal Zone Mileage Represents Statewide</u>	<u>Miles</u>
Asphalt	80%	4,766	43%	13,935
Concrete	9%	567	54%	1,037
Gravel	6%	353	65%	532
Interstate	5%	316	68%	459

Table 2.11 - Breakdown of Coastal Zone Road Types

Morgan City, Lafayette, Lake Charles and ultimately to California. The main line roughly parallels the coast but is located well inland. Four spurs serve Avery Island, Weeks Island, Houma and Valentine. Generally, it has been difficult to establish service to the coast because soil conditions are so unstable.

The Missouri Pacific traverses an east-west route roughly parallel to U.S. 190. It serves Baton Rouge westward to Opelousas and Eunice, with spur lines serving Crowley and St. Martinville.(6)

Texas Pacific serves the western bank of the Mississippi River as far south as Venice, and the Illinois Central serves the eastern bank as far south as New Orleans. The Illinois Central also provides a north-south line from New Orleans through Hammond on the western end of Lake Pontchartrain on the way to Illinois. Southern Railway System and the Gulf, Mobile and Ohio Railroad Company provide north-south service around the eastern end of Lake Pontchartrain. The Louisville and Nashville Railroad provides service from New Orleans eastward along the Mississippi Gulf Coast.(7)

3. Air Service

The coastal zone of Louisiana is served by four commercial airports. These include:(8)

<u>City</u>	<u>Airport</u>	<u>Airlines</u>
Baton Rouge	Ryan Field	Delta Royale S. Cent. Air Transport Southern Texas International
Lafayette	Lafayette Municipal Airport	Royale Texas International
Lake Charles	Lake Charles Municipal Airport	Texas International

<u>City</u>	<u>Airport</u>	<u>Airlines</u>
New Orleans	Moisant (New Orleans International)	Aviateca Braniff Continental Delta Eastern National Pan American Royale Sahas Southern TACA Texas International United S. Cent. Air Transport

A number of smaller cities with hard-surfaced and lighted airports are not served by commercial airlines.

<u>City</u>	<u>Length of Runway</u> <u>in feet</u>	<u>City</u>	<u>Length of Runway</u> <u>in feet</u>
Abbeville	3,000	Mamou	3,000
Crowley	4,300	New Iberia	8,000
Eunice	3,000	Opelousas	4,550
Hammond	5,000	Patterson	4,000
Houma	5,000	Slidell	3,000
Jennings	3,000		

Although Mamou and Opelousas are on the outer fringe of the general area utilized in compiling coastal zone data, they are on air routes serving cities within the fringe area and, as such, are pertinent to the table.

Numerous other cities and towns, have unlighted, hard surface, or turf airports. However, most of the air facilities are located at least 10 miles inland. A number of heliports and seaplane facilities have been constructed on the coast. They are generally concentrated around Morgan City, Grand Isle and Venice and serve the petroleum industry as refueling stops for aircraft transporting workmen to offshore oil rigs from other airports in the more populated area.(9)

4. Mass Transit

In Louisiana, mass transit systems have proven unprofitable but this has been the general result throughout the nation. The major cities of the coastal zone provide some mass transit through a conglomeration of private and publicly owned companies.

New Orleans Public Service, Inc., operates the largest mass transit system in the state. Fares have been kept low because costs of the transit division are offset by profit realized from gas and electricity divisions. The company's transportation routes traverse 352 miles, 13 of which are overlain with streetcar track still in use; otherwise buses are utilized. NOPSI maintains a fleet of 35 streetcars and 458 buses. Combined, they have traveled 14.4 million vehicle miles and transported 72.5 million fare-paying passengers. (10)

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10. The State of the State in 1973, An Economic and Social Report to the Governor, Louisiana Office of State Planning, prepared by the Division of Business and Economic Research.

E. Proposed Developments in the Coastal Zone

1. Superport

Based on declining domestic production of crude oil and rapidly rising demand for crude oil energy derivatives, the principal justification for constructing a superport is the economy of scale that results from transporting petroleum by supertanker. An example of the economics of supertanker use is shown in the following table. Costs quoted include construction and operation considerations.

Transportation Cost per Ton of Crude Oil
Persian Gulf--U.S. North Atlantic
By Size of Ship--1970(1)

<u>Cost Per Ton</u>	<u>Vessel Size</u> (dead weight tonnage)
\$17.9	25,000
12.6	47,000
10.5	80,000
5.7	250,000
5.2	500,000

Supertankers of 210,000 DWT (dead weight tonnage) require a channel depth of 60 feet and a channel width of about 70 feet. Vessels of 450,000 DWT require a channel depth of about 100 feet.(2) A projection based on ships under construction and on order in 1971 indicates that nearly 500 ships greater than 200,000 DWT and 1,000 ships of 100,000 DWT or larger will be in service by the end of 1976.

Because of channel depth constraints, there are no port facilities on the East or Gulf Coasts of the United States capable of handling supertankers. The Southwest Pass of the Mississippi River, for example, has a depth of approximately 40 feet. The obvious advantages of locating a superport in deep water off the coast of Louisiana include its proximity to a large refinery and pipeline transportation complex, and the Mississippi River's interconnection with the inland water system of the central United States.

Recognizing these advantages, and the economic growth potential inherent in superport related activity, the Louisiana Legislature created the Louisiana Deep Draft Harbor and Terminal Authority to promote and regulate superport development. Concurrent with this action, a corporation was formed,

with 14 major oil and pipeline companies as shareholders, to design, finance, construct, and operate a common carrier deep draft crude oil tanker unloading terminal.

This corporation, LOOP Inc., (Louisiana Offshore Oil Port), has submitted its plan to the State Authority, and its basic concept is outlined below.

The offshore unloading terminal will consist of five or more single-point moorings clustered around a central pumping station, located in 100 to 120 feet of water approximately 19 miles offshore. The five moorings will be a mile apart. The single point mooring, of which there are more than 100 in operation worldwide, is the heart of this system, allowing tankers to move in response to wind and tide by "weathervaning" 360° around the mooring. The off-loading connection is made by means of flexible hoses. The LOOP Inc. plan indicates this concept is the most feasible for operating conditions like those expected in the Gulf of Mexico.

From the offshore terminal, oil will be pumped to an onshore tank farm which eventually may reach a capacity of 50 million barrels. The proposed site of the LOOP tank farm is at Port Fourchon at the mouth of Bayou Lafourche. The site for the central pumping station of the LOOP port is in the vicinity of Grand Isle.

Approximately 50 superports are in some stage of construction or planning throughout the world, but none are under construction in the United States. The final decision to locate a superport off the coast of Louisiana necessitates consideration of a number of factors, including:

1. What effect will the superport have on the environment of the location chosen?
2. What are the long-range water transportation needs of the Gulf Coast area?
3. What type of onshore support facilities will be built?
4. Should provisions be made for solids carriers (for grains and ore) in superport design? What methods will be most effective for unloading super vessels in a multiuse port--barges, pipeline or combination?

The decision to built and where to build a superport depends on answers to these questions. Compromises between the positive and negative effects of superport development will lead to the best solutions. Alternatives will have to be scrutinized carefully.

2. Centroport

Centroport is the name of a plan devised for developing the Port of New Orleans into a port for the central United States(3). The basic philosophy underlying this plan for 30 years of development is the integration of land and water modes of transportation by use of a high efficiency, a high through put and a highly concentrated port installation.(4) Part of the plan for this development includes moving the port away from the existing, congested city waterfront to the junction of the Industrial Canal and the Mississippi River Gulf Outlet.(5) The new site will have four barge-carrier terminals (utilizing barges loaded aboard ships), four break bulk terminals, two special steel handling terminals, an expanded public bulk terminal and a container terminal.(6) This development should provide an impetus for new industrial growth in the area. Another hoped for benefit of the development of Centroport is that the barge terminal will provide a constant supply of work for longshore labor, since barges will almost always be loading or unloading.

3. Navigation Projects

The following section contains a listing of some of the larger navigation projects under consideration at present. (See Appendix Two for a more inclusive list.)

a. Barataria Bay Waterway--A proposal has been made to enlarge the existing channel. At present this 12-foot-deep by 125-foot-wide channel is 37 miles long. It extends from the Gulf Intracoastal Waterway near Crown Point in Jefferson Parish to the point of intersection of Bayou Lafourche and the Gulf of Mexico. The proposed enlargement is to provide a shortened navigation distance and to provide a reduction of traffic on the GIWW north of the project. The point at which this waterway intersects the Gulf is near one of the proposed superport sites.

b. Bayou Lafourche Auxilliary Channel-Jump Waterway--This proposal consists of two parts. The auxilliary channel is a 12-foot-deep by 125-foot-wide channel from the GIWW at LaRose to a point intersecting Bayou Lafourche at Leeville. The channel parallels Bayou Lafourche. The purpose of the proposed channel is to alleviate a congested area on Bayou Lafourche. The project would pass through portions of Bayou Blue, Grand Bayou Canal, and Grand Bayou Blue.

The second part of the project is a proposal for a 12-foot-deep by 125-foot-wide channel from Bayou Lafourche at Leeville via the Southwestern Louisiana Canal to a point north of Grand Isle. This project would facilitate the movement of oilfield equipment, sulfur, shell, shrimp and oysters.

c. Mississippi River Gulf Outlet--As the channel exists, it has dimensions 36 feet deep by 500 feet wide. The channel extends in a southeasterly direction for 76 miles from the Inner Harbor Navigation Canal in the Port of New Orleans to the Gulf of Mexico. The proposal under consideration is to enlarge the channel to 50 feet deep by 750 feet wide so some of the traffic that uses the Mississippi River will find this waterway attractive.

d. Calcasieu River Ship Channel--This is a relatively small project. The proposal is to enlarge an existing channel of 30 feet deep by 100 feet wide to 400 feet deep by 200 feet wide. Included in the project is a proposal to enlarge the existing turning basin from 30 feet by 500 feet by 750 feet to 40 feet by 750 feet by 1,000 feet. The purpose of the enlargement is to accomodate larger vessels for industrial users of the channel.

e. Atchafalaya River and Bayous Chene, Boeuf, and Black--This proposal calls for a 20-foot-deep by 400-foot-wide channel except at certain points where existing industries on both sides of the Bayous will allow a channel only 300 feet wide. The channel would extend from Highway 90 at Bayou Boeuf to the GIWW and from there to the 20-foot contour in the Gulf of Mexico. The channel would be approximately 45 miles long, 20 miles of which would be in the Gulf of Mexico.

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4. Masterplan New Orleans--Centroport USA.
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6. Ibid.

4. Flood Control

a. Lake Pontchartrain and Vicinity Hurricane Protection

The Lake Pontchartrain and Vicinity Hurricane Protection system is a combination of levees and drainage structures built on the south and east shores of Lake Pontchartrain and the western end of Lake Borgne to protect the developed areas of St. Charles, Jefferson and Orleans parishes from hurricane tides. Fig. 2.10, entitled Lake Pontchartrain and Vicinity Hurricane Protection, illustrates the system.

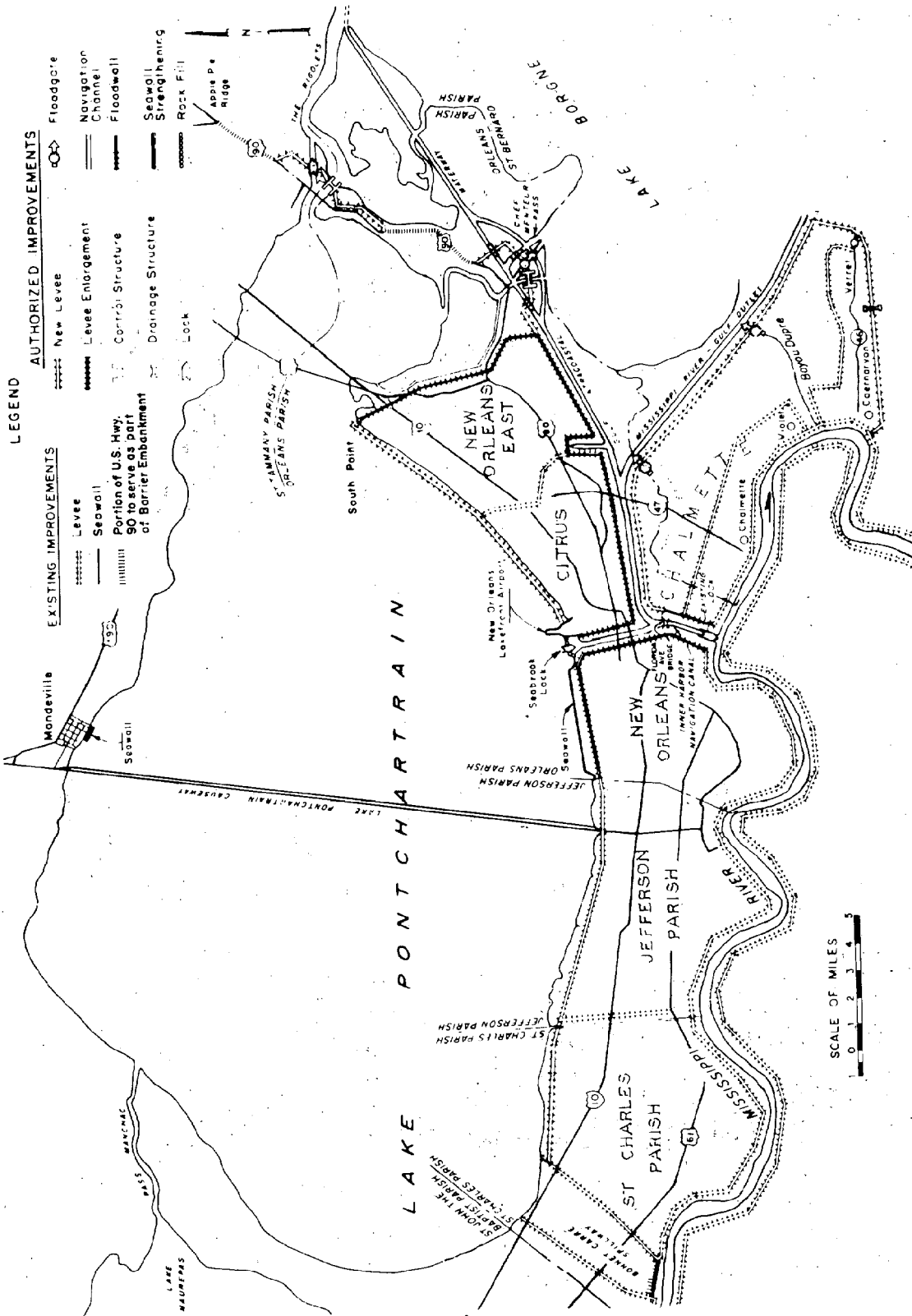
To facilitate discussion of the construction, the Lake Pontchartrain and Vicinity Hurricane Protection system can be broken up into a number of primary construction areas. (1)

1. Lake Pontchartrain Barrier Plan

This plan will provide a barrier across the east end of Lake Pontchartrain. Fig. 2.11, entitled Lake Pontchartrain Barrier Plan, shows perspective views of contemplated construction at the eastern end of the lake. At the Rigolets, construction will include a gated control structure, a navigational lock and channels, a closure dam and adjoining barrier levees. In Chef Menteur Pass, construction will consist of a gated control structure and attendant channels, a navigable flood gate and channels, relocation of the Gulf Intracoastal Waterway, a closure dam and adjoining barrier levees. In addition, the barrier plan calls for installation of a navigational lock and gated control structure at the lakeward terminus of the Inner Harbor Navigational canal in the vicinity of Seabrook.

2. Citrus and New Orleans East

The Lake Pontchartrain and Vicinity Hurricane Protection system will provide new levees along the lakeshore of Citrus and New Orleans East to South Point. The existing levee will be enlarged from South Point southwest to the Gulf Intracoastal Waterway. The levee along the north side of the waterway will also be enlarged as far west as the Inner Harbor Navigational Canal. Flood walls have been constructed in the Citrus area back levee along the west bank of the Michoud Canal and the east bank of the Inner Harbor Navigational Canal.



LAKE PONTCHARTRAIN AND VICINITY HURRICANE PROTECTION

Fig. 2.10 Source: U.S. Army Corps of Engineers

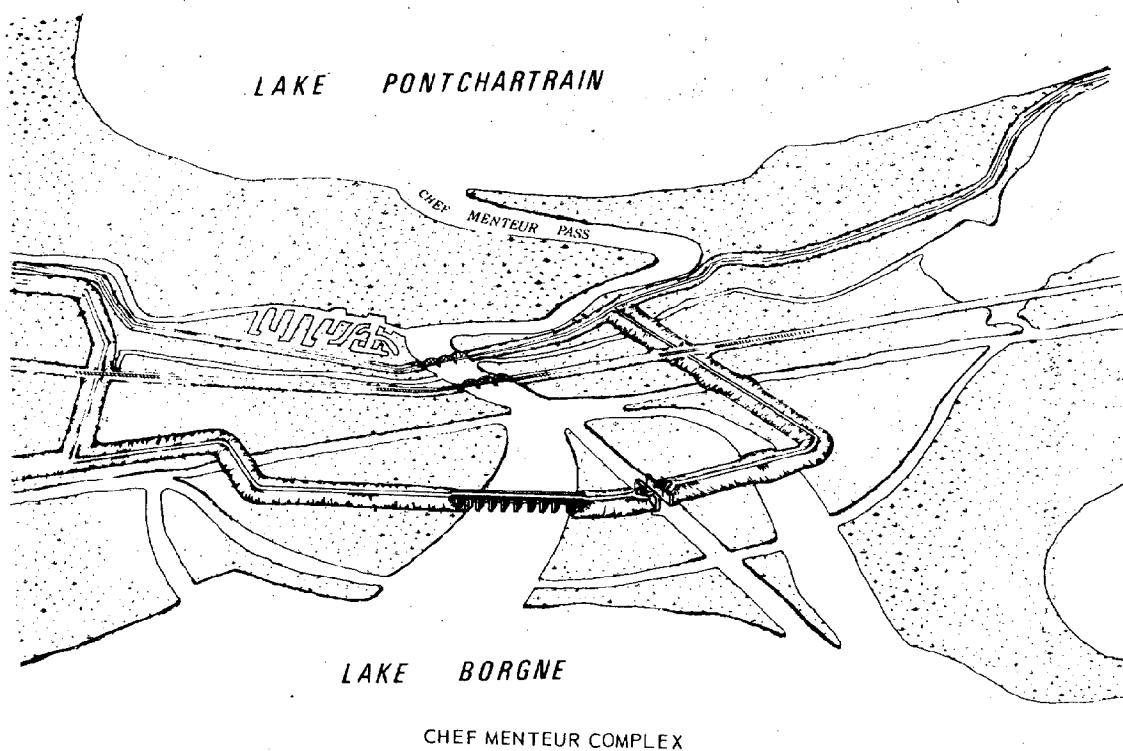
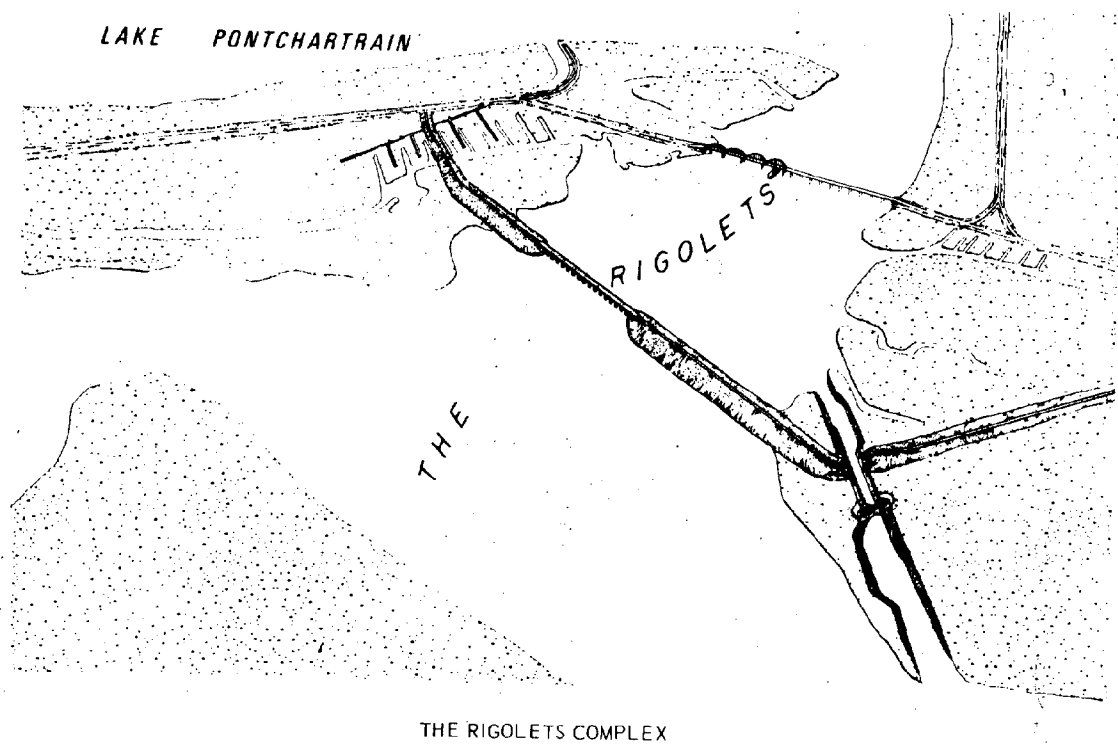


Fig. 2.11 Lake Pontchartrain Barrier Plan

3. Chalmette Area

The Lake Pontchartrain and Vicinity Hurricane Protection system provides for enlargement levees along the south side of the Gulf Intracoastal Waterway and the Mississippi River-Gulf Outlet, with drainage structures to be located on Bayou Bienvenue and Bayou Dupre. The levee will extend to the area of Bayou Dupree along the Mississippi River-Gulf Outlet. Then, a levee will be constructed southwest to the area of the town of Verret, crossing Louisiana Highway 46. Construction will continue in a westerly direction to the vicinity of Caernavon, where it will intersect with the Mississippi River Levee. The levee and seawall along the east bank of the Inner Harbor Canal to the Gulf Intracoastal Waterway will be improved and strengthened. No improvements are planned for the Mississippi River levee which will constitute the southeastern boundary of the protected area.

4. New Orleans, Jefferson and St. Charles Parish Area

The Lake Pontchartrain and Vicinity Hurricane Protection system includes construction of a new levee from the east side of the Bonnet Carre Spillway to the St. Charles-Jefferson Parish line along the southern shore of Lake Pontchartrain. The new levee will connect with an existing levee along the Jefferson Parish lakeshore. This levee will be enlarged from the Orleans Parish-Jefferson Parish line to the Inner Harbor Navigational Canal. The levee along the eastern side of the Inner Harbor Navigational Canal has been enlarged along the full length of the canal with the exception of section just north of the navigational lock at the Mississippi River end of the Inner Harbor Navigational Canal. The plan does not include improvements to the Bonnet Carre Spillway or the Mississippi River levees on the south and west side of the area, respectively.

Estimated cost of the overall project is \$216 million. Approximately \$67.16 million must be supplied by nonfederal interests. Construction was initiated in 1967.

b. Grand Isle and Vicinity Hurricane Protection Plan

The Grand Isle and Vicinity Hurricane Protection Project was authorized by the Flood Control Act of 1965. It is intended to protect the highly developed area along Bayou Lafourche between Larose and Golden Meadow from high water caused by storms. (3)

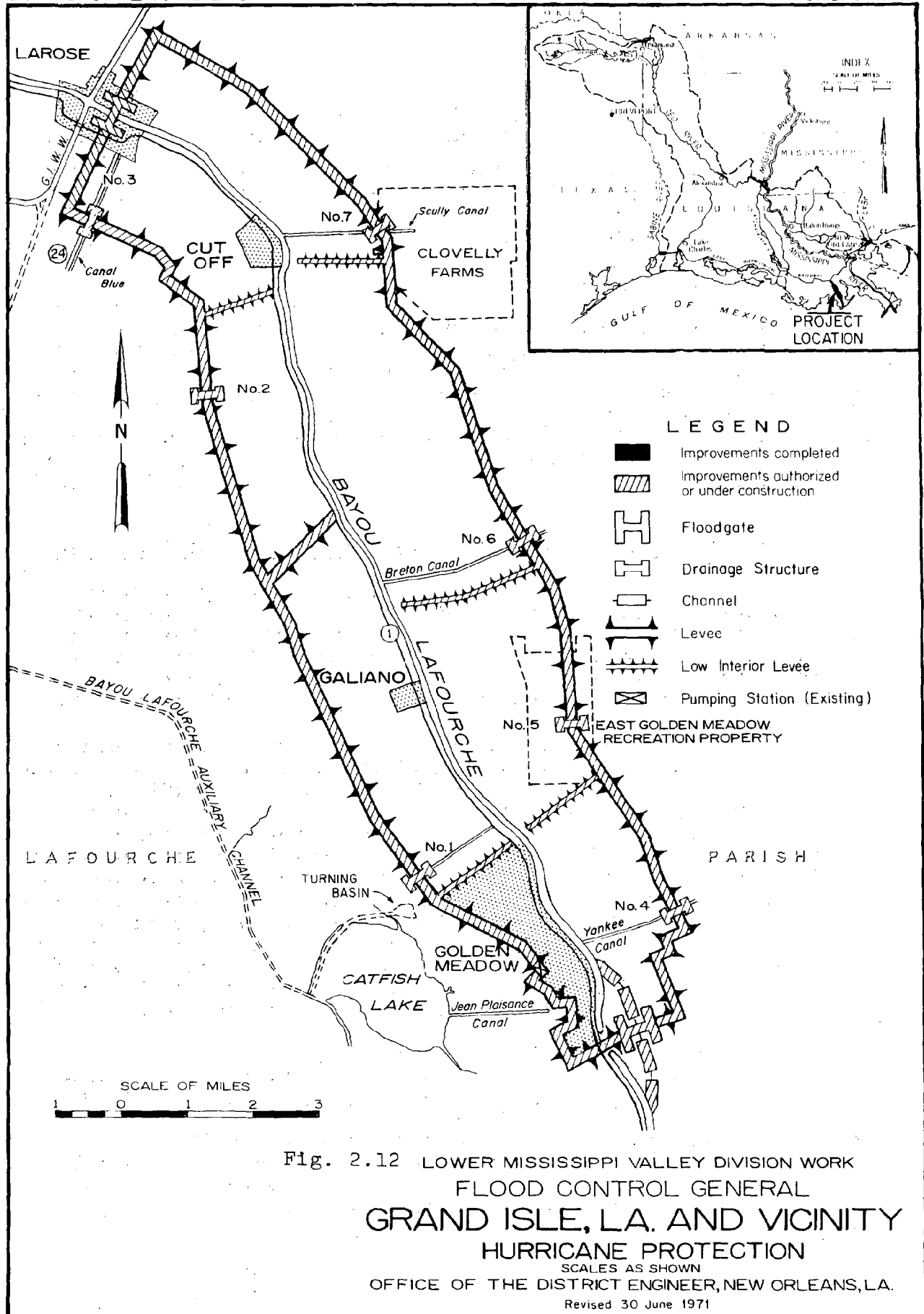
Fig. 2.12, entitled Grand Isle, La., and Vicinity Hurricane Protection, provides an overall diagram of the project.(4) The system includes a loop levee about 36 miles long on either side of Bayou Lafourche from Golden Meadow to Larose. Three miles of existing levee near Golden Meadow will be enlarged; the remainder will be new levee. Flood gates will be provided in Bayou Lafourche at both the north and south ends of the protected area. A new channel will be dredged in conjunction with construction of the floodgate in the Golden Meadow area. Seven drainage structures will be placed in the protective loop levee. Generally speaking, these structures will be multibarreled culverts with flap gates to control the direction of the water flow. These drainage structures on the east side of Bayou Lafourche will be located at Yankee Canal near Golden Meadow, Breton Canal, Scully Canal and in the Cut Off vicinity. On the west side of Bayou Lafourche, drainage structures will be located at Canal Blue near Larose, south of Cut Off and north of Golden Meadow. About eight miles of interior levees are also planned to intercept and regulate drainage. These will be on either side of Bayou Lafourche north of Golden Meadow, south of Cut Off and on the east side of Bayou Lafourche south of Breton Canal.

At this time, the project is still in planning stages; construction will commence as soon as funds are made available. Nonfederal interests are required to bear 30 per cent of the total cost. In other words, nonfederal participation will be \$4.02 million and federal participation will be \$9.39 million. Total cost of the project will be \$13.41 million.(5)

c. New Orleans to Venice Hurricane Protection Plan

New Orleans to Venice Hurricane Protection project was authorized by the River and Harbor Act of 1962, under the title "Mississippi River Delta at and Below New Orleans." The project was intended to protect the area along the Mississippi River south of New Orleans, which has proved particularly vulnerable to hurricane flooding.(6)

The project is described by the schematic diagram, Fig. 2.13, entitled New Orleans to Venice, Louisiana. (Hurricane Protection).(7) Primarily, the project will include enlargement of existing back levees, constructing new back levees, modifying existing drainage facilities, a barrier levee on the east side of the Mississippi River to block hurricane surges from the east. A flood gate is to be installed at Empire in the Empire to Gulf Waterway. The project is divided into four independent reaches:(8)



<u>Reach</u>	<u>Description</u>	<u>Length</u>	<u>Estimated Cost</u>
A	City Price to Tropical Bend	13 mi.	\$11.85 million
B-1	Tropical Bend to Fort Jackson	12 mi.	20.38 million
B-2	Fort Jackson to Venice	8 mi.	6.97 million
C	Phoenix to Bohemia	16 mi.	10.71 million

The first lift of the levee in Reach C was constructed by local interests in lieu of a cash contribution. It will be necessary to raise the levee further to design height. Credit will be given for the 30 per cent nonfederal participation required.(9) About 9,800 feet of the first lift levee embankment within Reach B-1 was completed in May 1969. The second lift in that reach is now under contract. An additional 27,300 feet of the first lift of the levee between the Empire floodgate and a point below Buras was completed in November 1971.(10)

d. Morgan City and Vicinity Hurricane Protection Plan

The purpose of the Morgan City and Vicinity Hurricane Protection project is to provide protection from hurricane floods for the developed area extending from Morgan City to the Charenton Drainage and Navigational Canal.(11) The project is located in St. Mary Parish in south central Louisiana about eighteen miles from the Gulf of Mexico.(12)

The project is described in fig. 2.14, entitled Morgan City and Vicinity Louisiana Hurricane Protection. Construction will be divided into two general areas. The first is in the Morgan City vicinity. A new levee will be built along the southwest side of Lake Palourde and the west side of Bayou Ramos. Also a short stretch of new levee will be built in the vicinity of the Bayou Boeuf lock. Three drainage structures are to be included in the levees. The second general area is the Franklin vicinity. Here, construction will be primarily enlargement of an existing levee system running along the north side of the Gulf Intracoastal Waterway, the east side of Thorgeson Canal, then west to Hanson Canal, Franklin Canal and the Charenton Drainage and Navigational Canal.

New levees will be built in the vicinity of Bayou Sale connecting the existing levees on the north bank of the Gulf Intracoastal Waterway and the east side of Thorgeson Canal and along the east bank of the Charenton Drainage and Navigational Canal connecting the existing levee with the area of the U.S. 90 Highway. Six pumping stations will be enlarged and seven flap-gated drainage structures will be

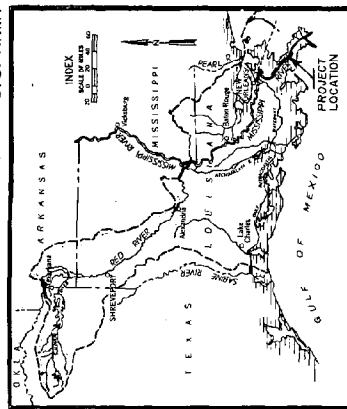


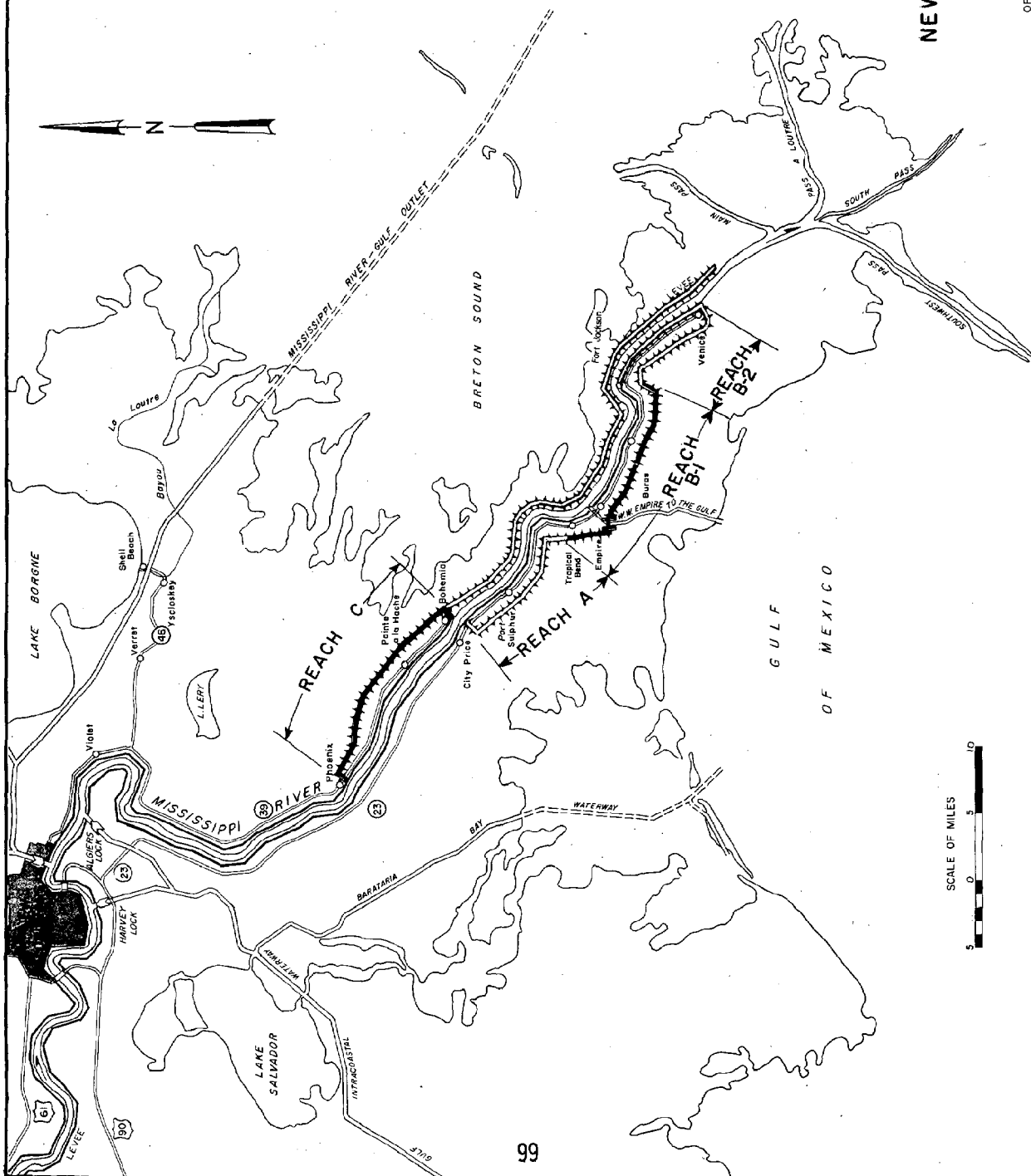
Fig. 2.13

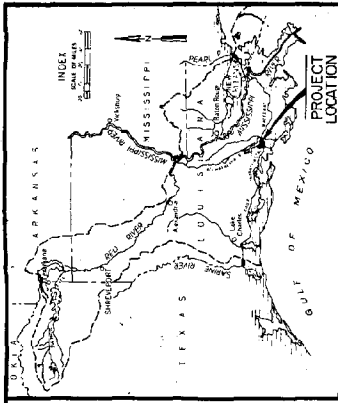
- LEGEND**
- Improvements complete
 - Improvements under construction
 - Improvements authorized
 - Levee
 - Floodgate

NEW ORLEANS TO VENICE, LA.
(HURRICANE PROTECTION)

LOWER MISSISSIPPI VALLEY DIVISION WORK
FLOOD CONTROL GENERAL

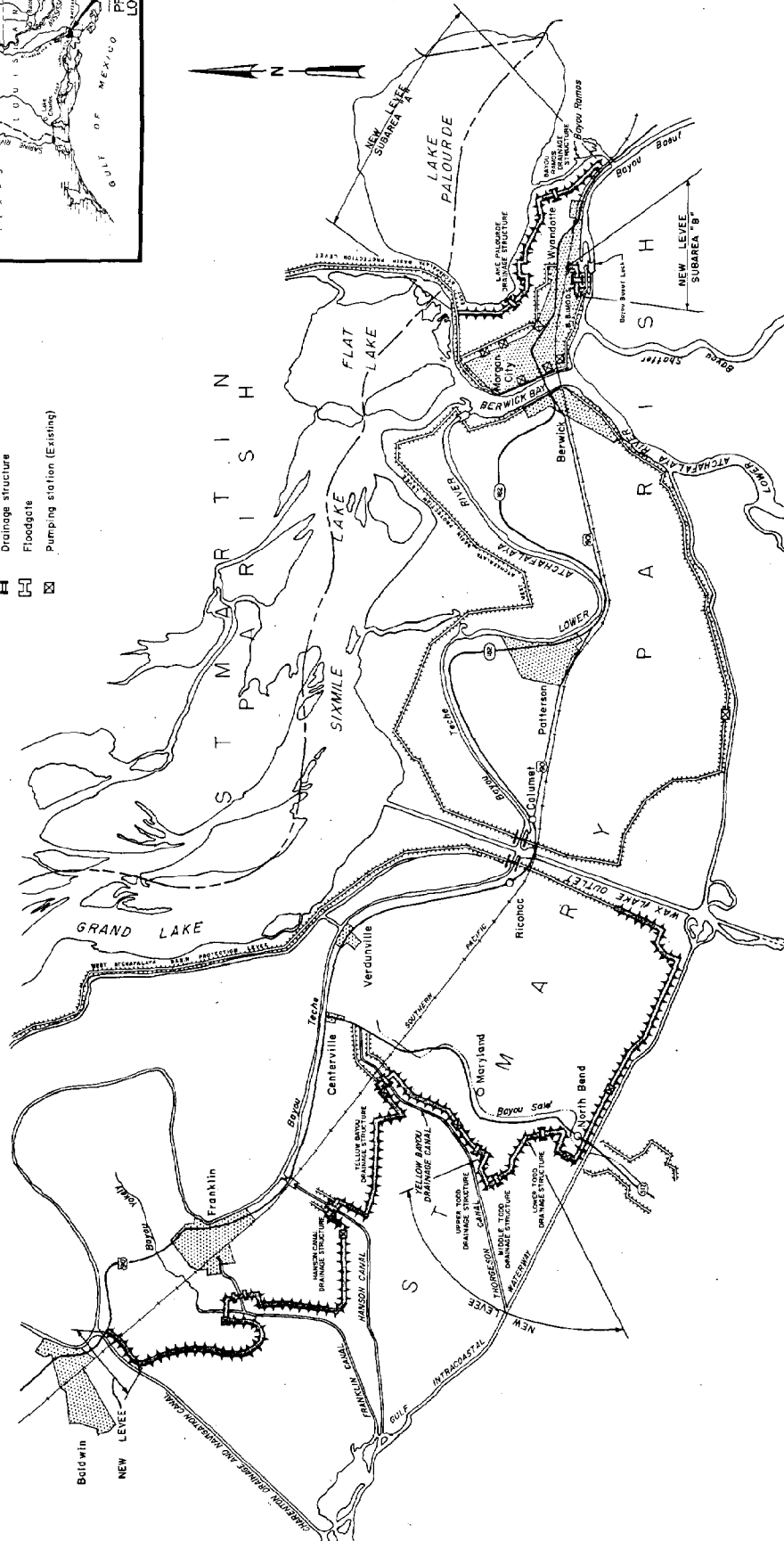
SCALES AS SHOWN
OFFICE OF THE DISTRICT ENGINEER, NEW ORLEANS, LA.
Revised 30 June 1972





LEGEND

- Improvements authorized
- Levees
- Levees not in this project
- Drainage structure
- Floodgate
- Pumping station (Existing)



SCALE OF MILES



LOWER MISSISSIPPI VALLEY DIVISION WORK
FLOOD CONTROL GENERAL
MORGAN CITY AND VICINITY, LA.
HURRICANE PROTECTION
SCALES AS SHOWN
OFFICE OF THE DISTRICT ENGINEER, NEW ORLEANS, LA.
Revised 30 June 1972

installed in the levee. A floodgate structure will be built where the enlarged levee crosses the Franklin Canal.

Detailed planning of the project is now in progress. Estimated cost of the project is \$7.21 million, of which \$2.25 million will be borne by federal interests.(13)

e. Atchafalaya Basin Flood Protection Plan

One flood control proposal for the Atchafalaya Basin is a channel 57.7 miles long with a cross sectional area of 100,000 square feet. This channel would run from a point on the northern part of the boundary between Iberville and St. Martin parishes to Morgan City.

The cross sectional area of this proposed channel is slightly greater than the surface area of two football fields. The existing channel in the upper 41.7 miles of the route has a cross sectional area of 60,000 square feet. This channel would have to be enlarged by 5/6 the area of a football field. In this lower 16.0 miles, the existing channel has an area of 40,000 square feet so the enlargement would be 1 1/4 of this area of a football field.

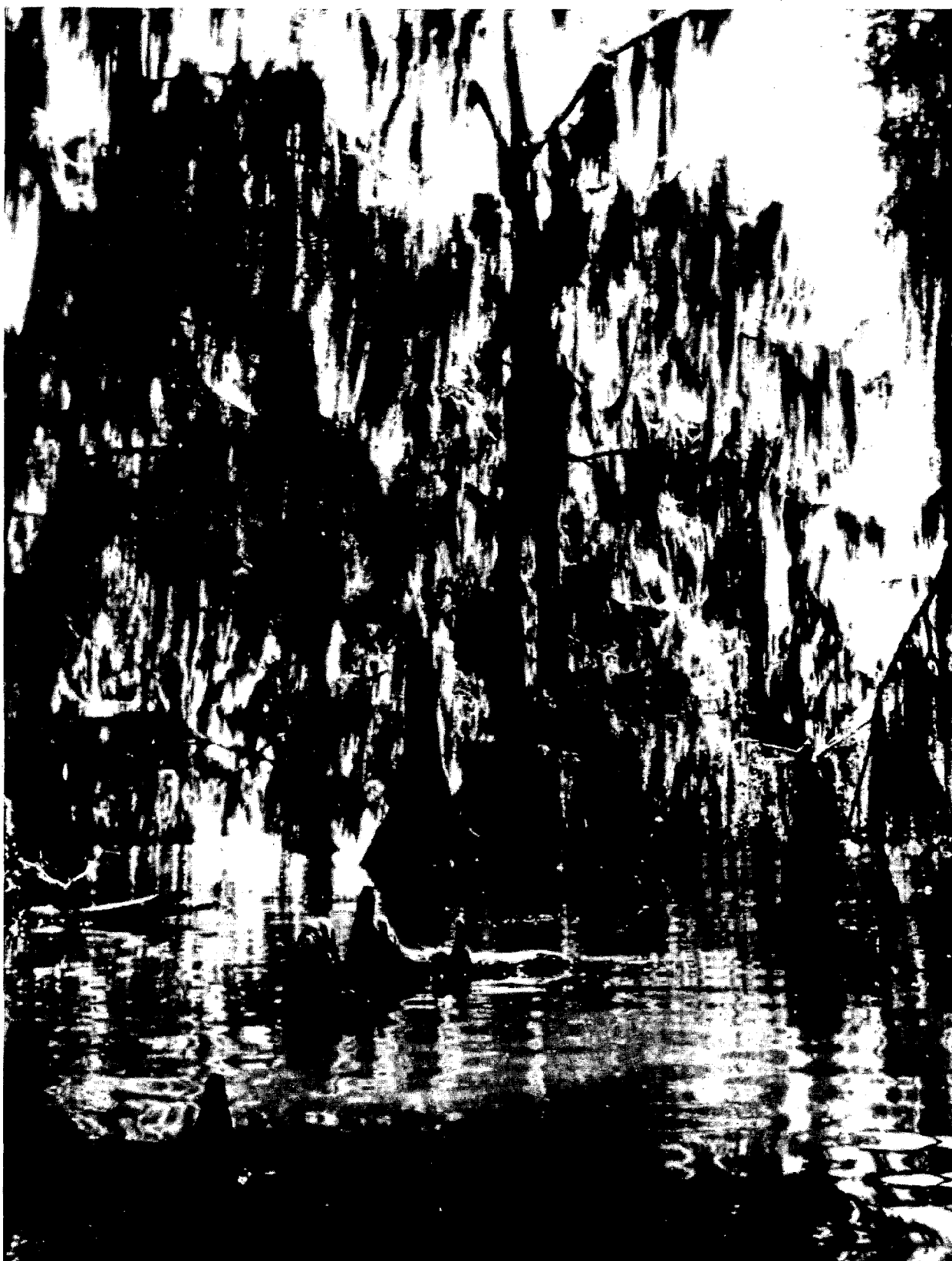
The purpose of the channelization is to prevent some of the flooding that occurs in the Atchafalaya Basin. Opponents of the plan say that the channel would drain the Atchafalaya Swamp and destroy its wildlife resources.*

*Oliver Houck, Good News from the Old Atchafalaya, Field and Stream, July, 1973.

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11. Water Resources Development, op.cit., p. 107.
12. Project Maps, op.cit., pp. 2-36A.
13. Water Resources Development, op.cit., p. 107.





CHAPTER THREE

TRENDS IN LOUISIANA'S COASTAL ZONE

- I. Living Resource Trends
 - A. Population
 - 1. Characteristics
 - 2. Composition
 - B. Recreation
 - C. Agriculture
 - D. Fisheries
 - 1. Fish and Shellfish
 - 2. Oysters
 - 3. Shrimp
- II. Economic Trends in the Coastal Zone
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 - 3. Waterborne Commerce
- III. The Changing Coastal Zone
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 - C. Land Loss
- IV. Conclusion

CHAPTER THREE

TRENDS IN LOUISIANA'S COASTAL ZONE

The preceding chapter, an inventory of coastal zone resources and past and present uses of these resources, provides a picture of the coastal zone as it is now. However, in order to manage wisely, we must have some conception of what the future holds for the Louisiana coastal region.

We can look into the future--at least a little way--by examining significant past and present trends of resource uses. In this chapter, efforts are made to open a small window to the future by reviewing these trends.

I. Living Resource Trends

A. Population Characteristics

Projected population trends for Louisiana indicate that the number of inhabitants will continue to increase at a relatively high rate. From 1950 to 1960, the increase was 21.4 per cent and, from 1960 to 1970, it was 11.8 per cent. Projections for 1970 to 1985 indicate a 32 per cent increase from 3,641,306 to 4,146,327 inhabitants. (Fig. 3.1).

The coastal zone and the noncoastal area of Louisiana have shown divergent growth rates. While the coastal zone has maintained a steady growth rate, the noncoastal area has shown only a slightly increasing trend from 1950 to 1970. The change of population in the coastal zone from 1950 to 1970 was 51 per cent. In the noncoastal area, it was 15 per cent. The high growth parishes in the coastal zone between 1950 and 1970 were East Baton Rouge, Jefferson, Plaquemines, St. Bernard, St. Charles, St. Tammany and Terrebonne.

Projections from 1970 to 1985 indicate that the number of inhabitants in the coastal zone will increase but the noncoastal area will level off, with a slight decline between 1975 and 1985. The projected growth from 1970 to 1985 for the coastal zone is 24 per cent but a 3 per cent decline seems probable in the noncoastal area (Fig. 3.1).

POPULATION TRENDS
For Louisiana, Coastal Zone and Noncoastal Area
From 1950-1985

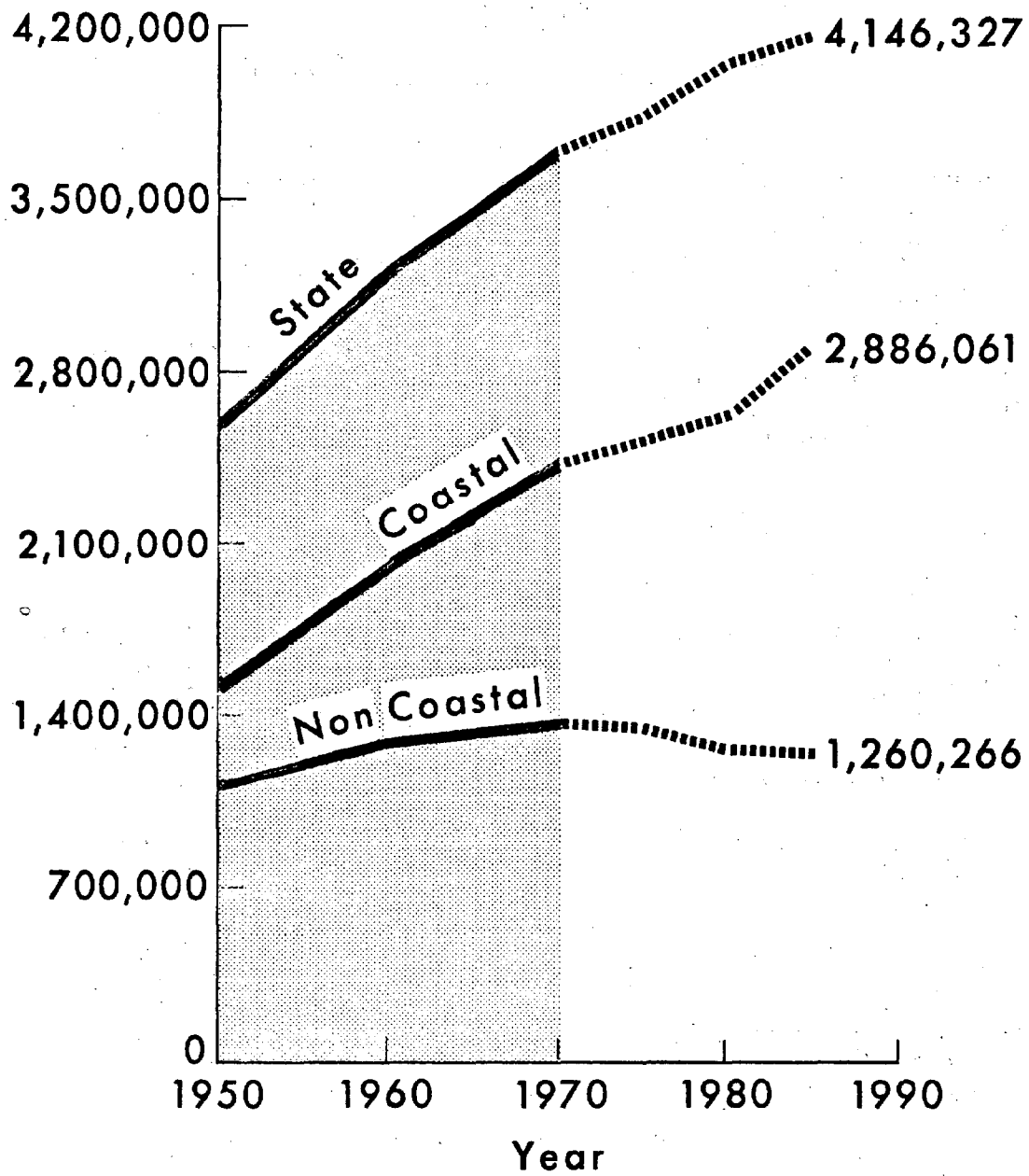


Fig. 3.1 Source: Population Projections By Age, Race, and Sex For Louisiana and Its Parishes 1970-1985 by Roger L. Burford and Sylvia G. Murzyn.

2. Composition

Over the years, Louisiana's population has become more urban. In 1970, two thirds (66.1 per cent) of the people of the state lived in places defined by the United States Census as urban. All persons living in places of 2,500 or more inhabitants are considered residents of an urban area. The number and distribution of urban and rural inhabitants in Louisiana for 1970 can be seen in Fig. 3.2 In 1970, twelve parishes in the coastal zone were classified as more than 50 per cent urban. This dramatic shift from rural to urban in the coastal zone is indicated in Figs. 3.3 and 3.4. Although the total population in the coastal zone has increased, the rate of urbanization has been much greater. From 1950 to 1970, the noncoastal area also became more urban but at a much slower rate than the coastal zone.

In summation, the coastal zone of Louisiana is an area of rapid growth in comparison to the noncoastal area and is increasingly more urban than the remainder of the state. This trend should continue through 1985.

Population projections for 1985 indicate that both the coastal and noncoastal areas will experience a notable drop in the male and female groups from 10 to 19 years old. This can be attributed either to a low birth rate in 1975 or a high out-migration rate. The large number of males and females in the 20 to 34 age category may reflect a large in-migration.

B. Recreation

The climate and abundance of fresh water and saltwater areas in Louisiana have provided the residents many opportunities for recreational uses. Activities include fishing, boating, camping, hunting, and swimming, which are a few of the more popular forms of recreation.

As the state's population increases over the next 15 years, greater demand will be placed on present facilities and a need will arise for new ones. If we examine projections for water activities which include motor boating, water skiing, canoeing and sailing (Fig. 3.5) we see a dramatic increase for the coastal zone in terms of user days from 1970 to 1985 while the noncoastal area will experience a decline after 1980. These figures reflect primarily a change in the population for each area but this determines the need for facilities in a given area. Fig. 3.6 is a projection of hunting, fishing, crabbing and crawfishing in

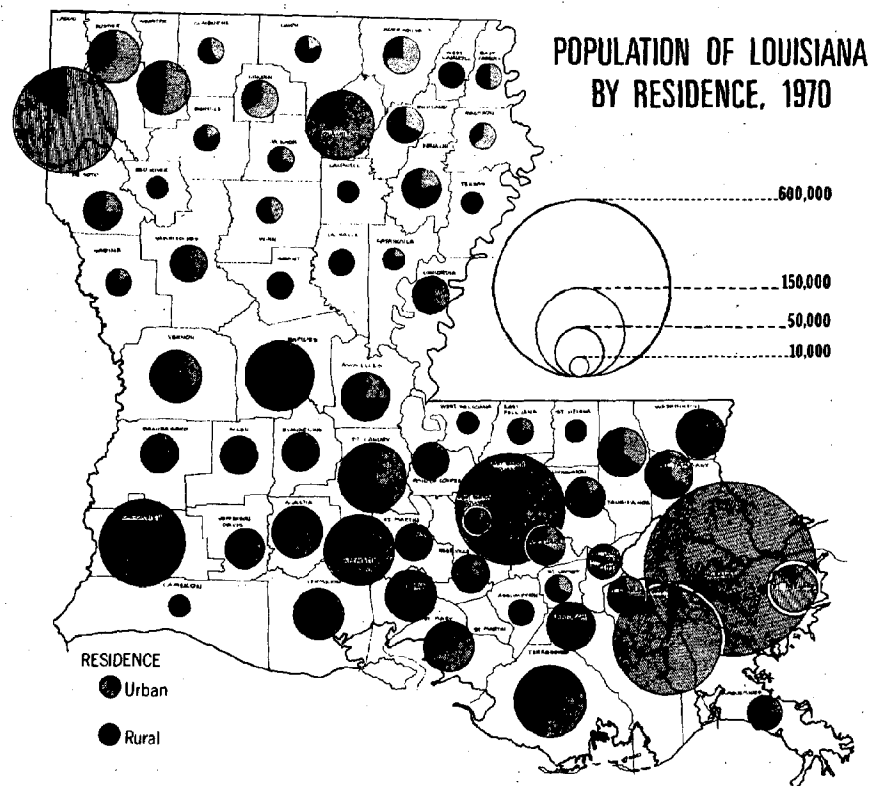


Fig. 3.2 Source: Paterson, Karen W. and Alvin L. Bertrand. Department of Rural Sociology, LSU-BR, 1972. Louisiana's Human Resources, Bulletin No. 661, April.

LOUISIANA POPULATION BY URBAN-RURAL COMPONENTS
FOR THE COASTAL AND NONCOASTAL AREAS. 1950, 1960, and 1970

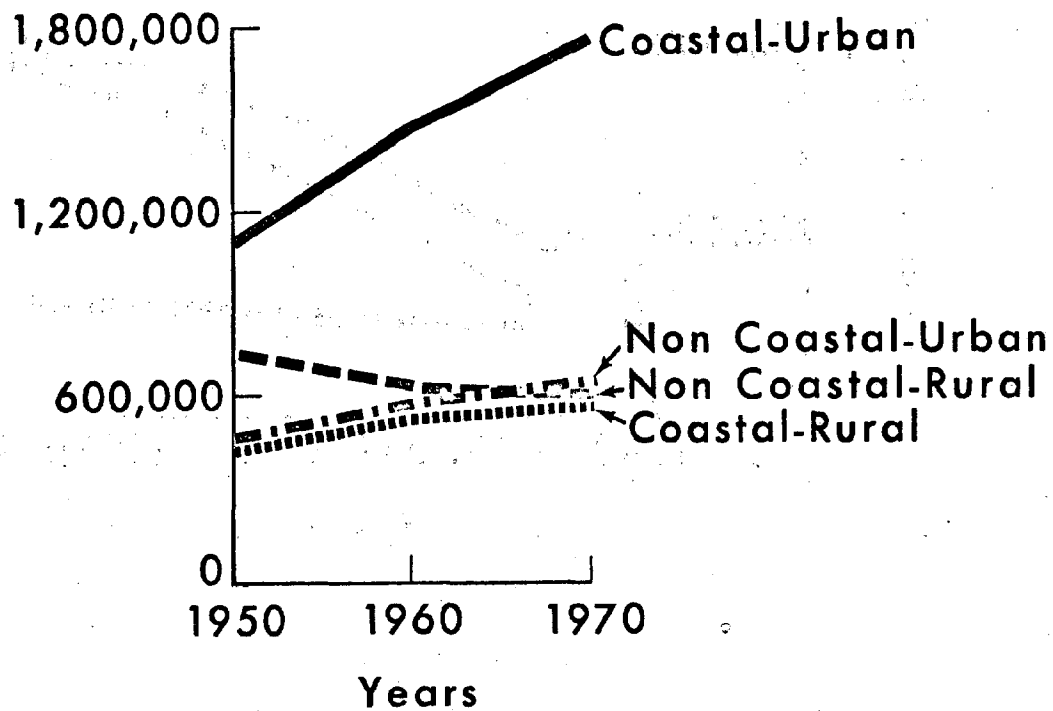


Fig. 3.3

Source: Table 9, U.S. Bureau of the Census
U.S. Census of Population: 1970,
Number of Inhabitants, Final
Report PC(1) A 20 La.

Table 5, U.S. Bureau of the Census,
U.S. Census of Populations: 1950
Vol. II, Characteristics of the
Population, Part 18, Louisiana.

NUMBER OF URBAN AND RURAL RESIDENTS
IN THE COASTAL ZONE OF LOUISIANA
1940, 1950, 1960, and 1970

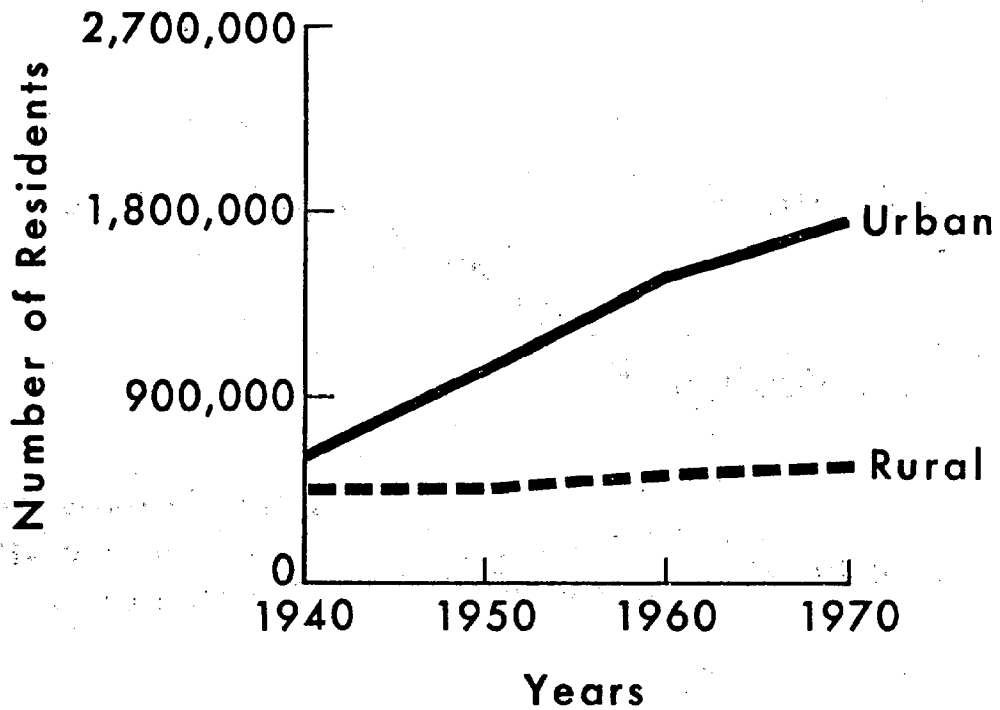


Fig. 3.4

Source: Table 5, U.S. Bureau of the
Census, U.S. Census of Population:
1950, Vol II, Characteristics of
the Population, Part 18, Louisiana.

RECREATION PROJECTIONS FOR 1980, 1985

Water Activities
Motor Boating, Water Skiing, Canoeing and Sailing
For the Coastal and Noncoastal Areas of Louisiana

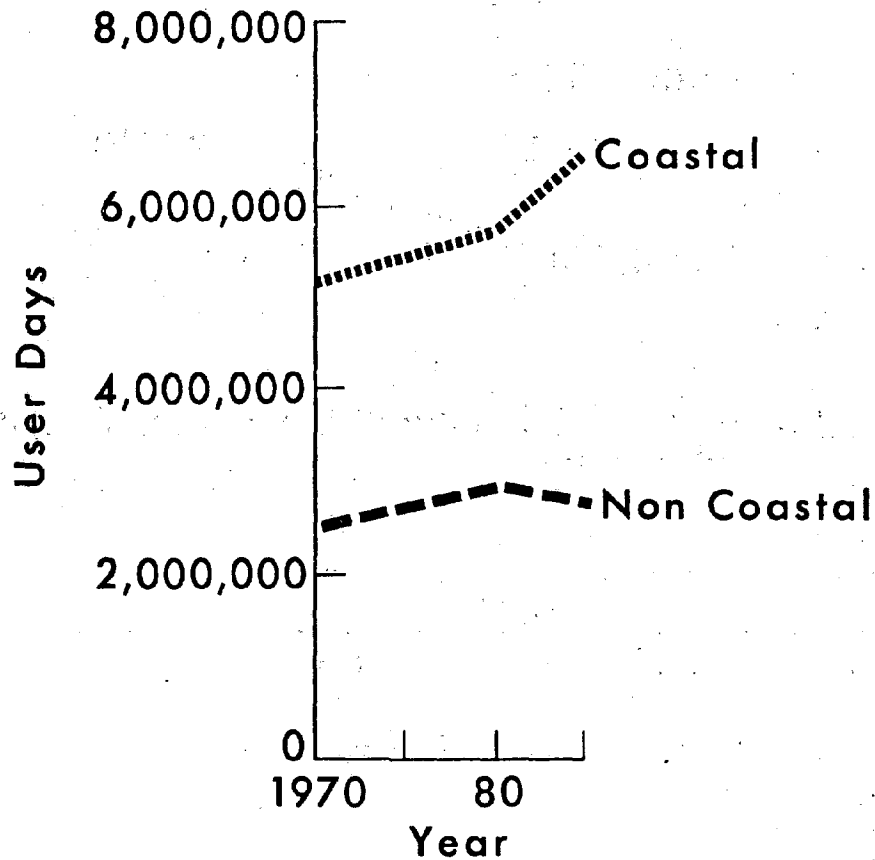


Fig. 3.5

Source: Table II, Comprehensive Outdoor Recreation Plan 1970-1975, Prepared by State Parks and Recreation Commission 1971.

LOUISIANA RESOURCE BASED RECREATION PROJECTIONS
Hunting, Fishing, Crabbing and Crawfishing
1980 to 1985

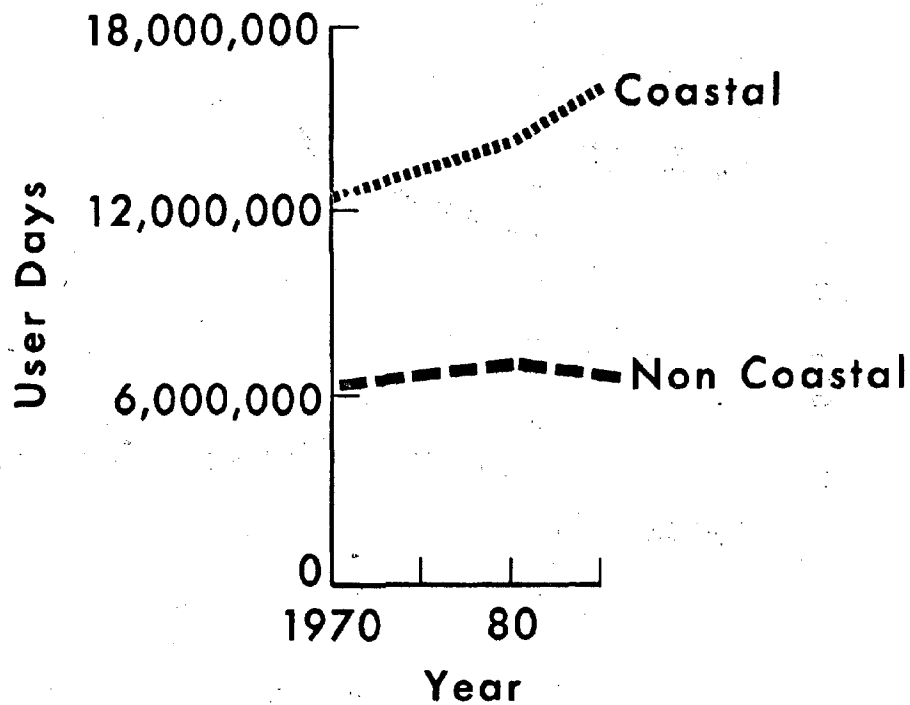


Fig. 3.6

Source: Table II, Comprehensive Outdoor Recreation Plan 1970-1975, Prepared by State Park and Recreation Commission 1971.

terms of user days from 1970 to 1985. Again, the coastal zone shows an upward trend but indications are that the noncoastal area will decline in terms of user days. Camping (Fig. 3.7), both tent and trailer, should increase in terms of user days in the coastal zone and level off after 1980 in the noncoastal area. Swimming in pools and on beaches (Fig. 3.8) shows a steady increase in number of user days in the coastal zone but the noncoastal area declines sharply after 1980. This may be the result of a decline in population and an increasingly older population less interested in such an active form of recreation as swimming.

These projections of user days for the various forms of recreation point to a need for programs ensuring that the natural beauty and environmental quality are maintained while, at the same time, new facilities and areas are created to meet increasing demand.

In summation, because of the high growth rate in the coastal zone and increased urbanization, a need will arise for additional recreational facilities in this area. The impact of this growing population on the natural resources in the coastal zone will become increasingly evident after 1980.

c. Agriculture

Agriculture in Louisiana is big business, amounting to more than \$512 million in 1971. Farming accounted for 3.5 per cent of the gross state product of Louisiana in 1971 (Table 1, The Louisiana Economy, Vol. VI, No. 4). The amount of land devoted to farming in Louisiana has declined steadily to the present figure of about 11.8 million acres while the size of the average farm has increased to 246 acres (The Louisiana Economy, Vol. VI, No. 4, May, 1973).

In the coastal zone, the amount of land utilized in farming has declined slowly from more than 3.9 million acres in 1954 to 3.4 million acres in 1969 but the noncoastal area has declined from slightly more than 7.5 million acres in 1954 to 6.3 million acres in 1969. This is an 11 per cent drop in the coastal zone and a 16 per cent decline in the noncoastal area from 1954 to 1969 (Fig. 3.9).

Like many other states, Louisiana has shown a downward trend in the number of farms (Fig. 3.10), but an increase in the average size of the farms. From 1959 to 1973,

RECREATION PROJECTIONS
FOR THE COASTAL AND NONCOASTAL AREAS OF LOUISIANA
Camping - Tent and Trailer
1980 and 1985

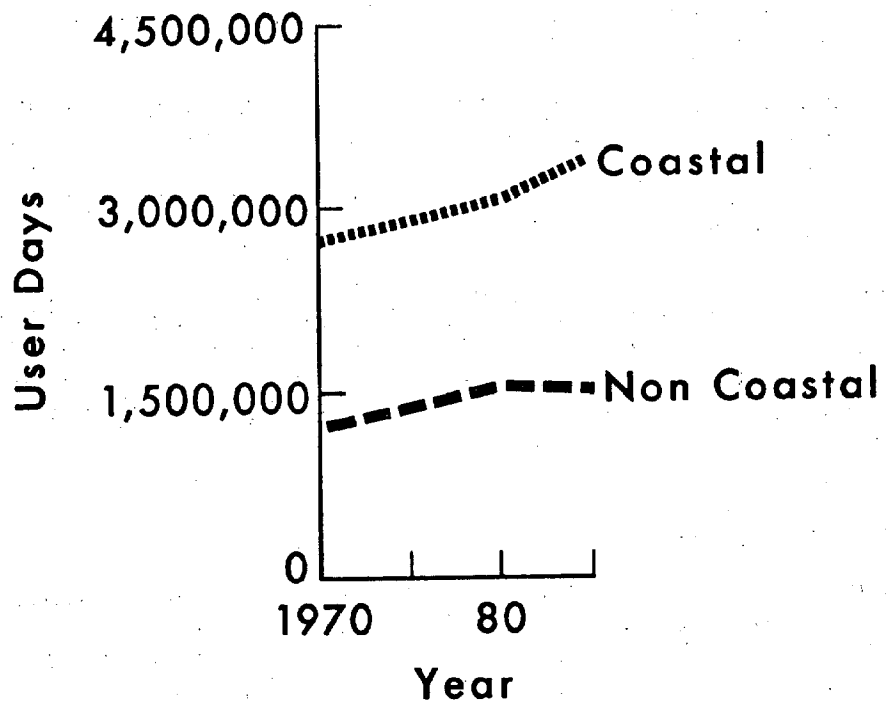


Fig. 3.7 Source: Table II Comprehensive Outdoor
Recreation Plan 1970-1975
Prepared by State Parks and
Recreation Commission 1971.

RECREATION PROJECTIONS
FOR NUMBER OF USER DAYS OF SWIMMING (POOL AND BEACH)
IN THE COASTAL AND NONCOASTAL AREAS OF LOUISIANA
1980 to 1985

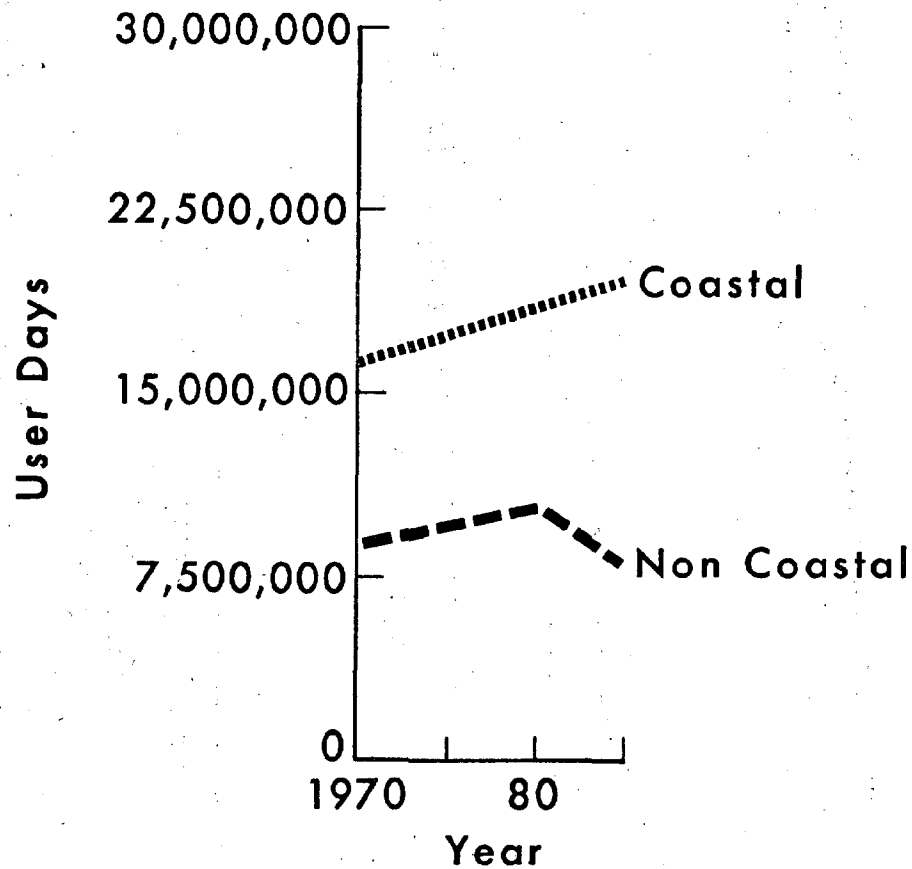


Fig. 3.8

Source: Table II, Comprehensive Outdoor Recreation Plan 1970-1975
Prepared by State Parks and Recreation Commission 1971.

LAND IN FARMS FOR LOUISIANA
COASTAL ZONE AND THE NONCOASTAL AREA
1954, 1959, 1964 and 1969

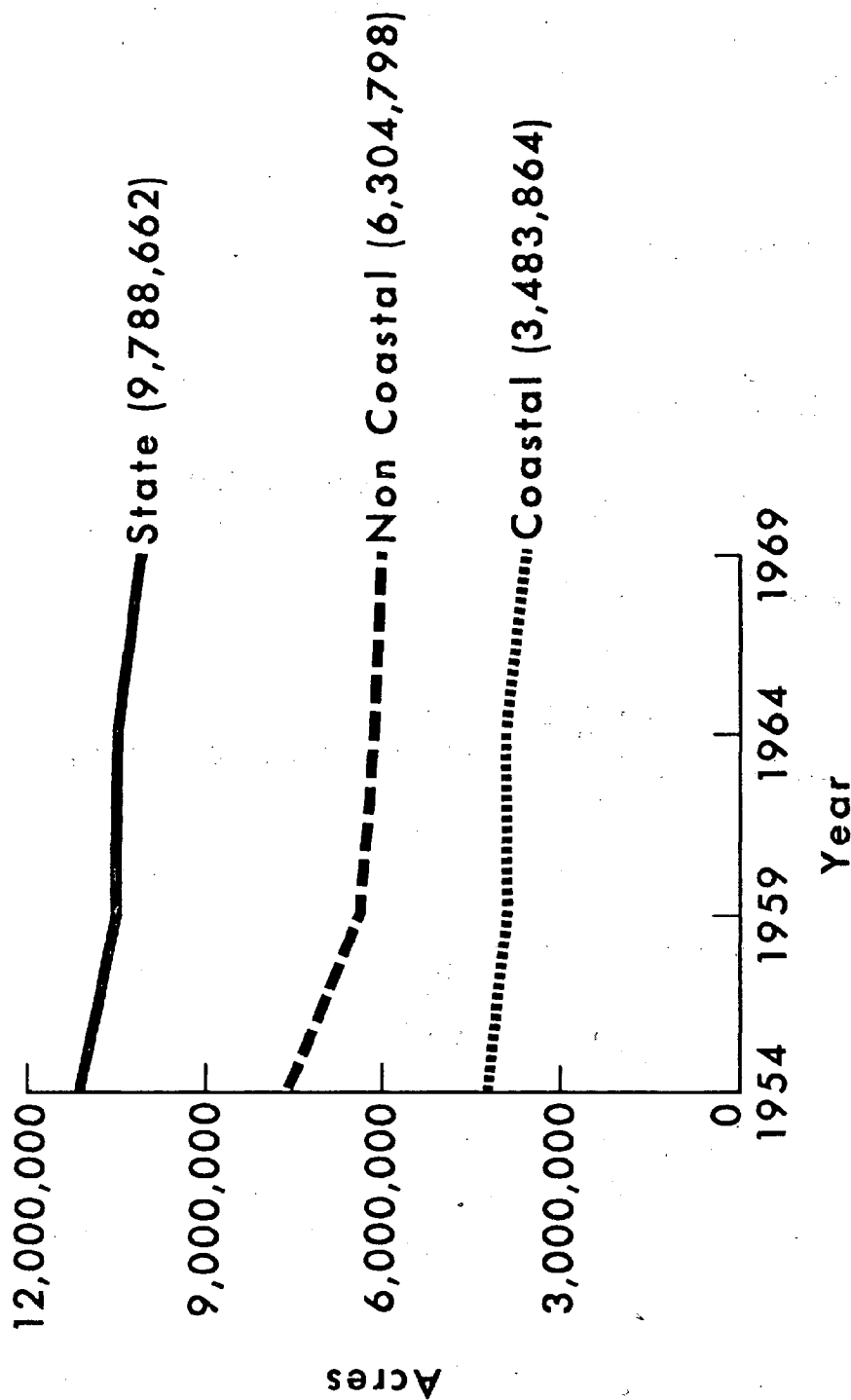


Fig. 3.9 Source: Table I, U.S. Bureau of the Census of Agriculture 1969, Volume 1, Area Reports Part 35, Louisiana Section 2, County Data.

NUMBER OF FARMS IN LOUISIANA
THE COASTAL ZONE AND THE NONCOASTAL AREA
1954, 1959, 1964, and 1969

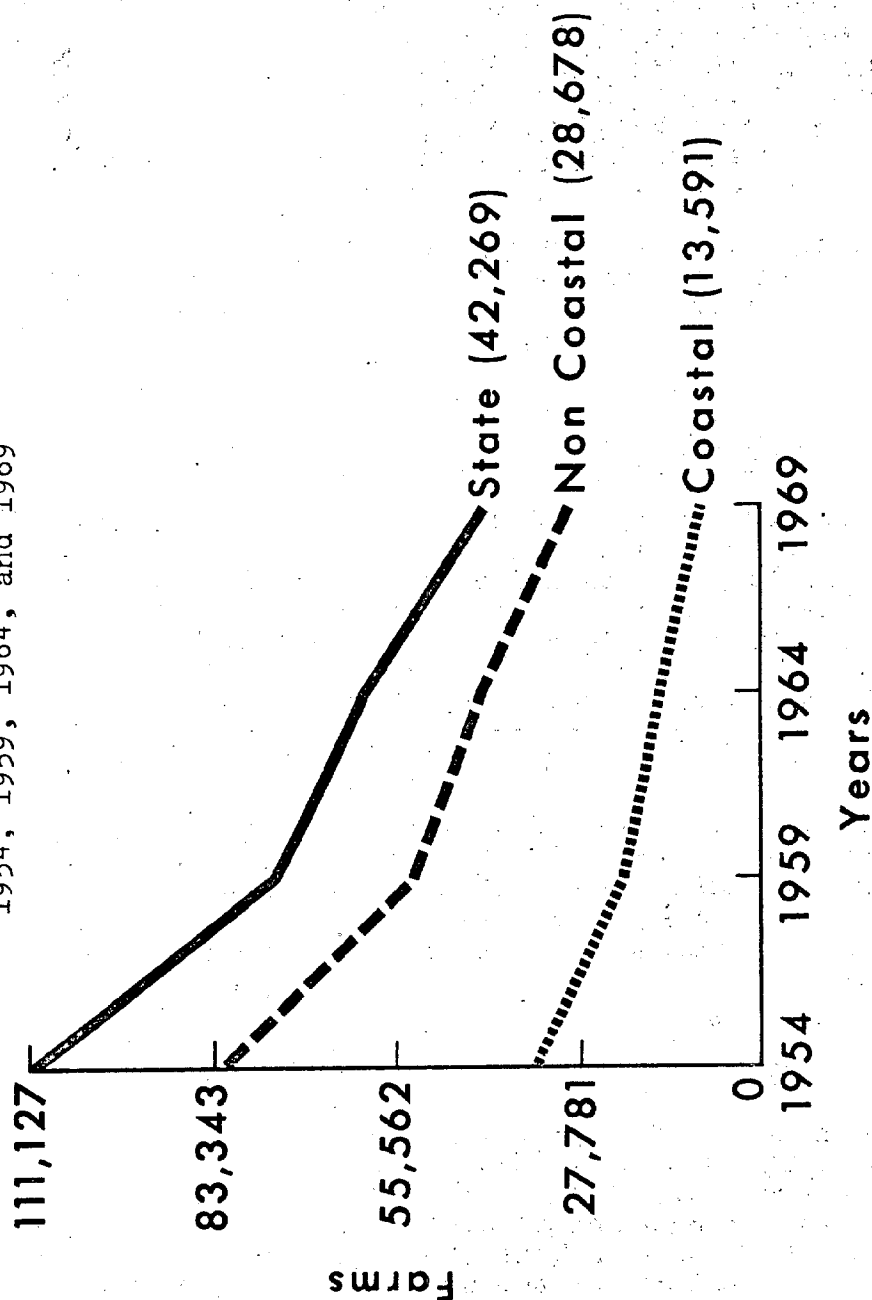


Fig. 3.10 Source: Table 3, U.S. Bureau of the Census, Census of Agriculture, 1969 Volume 1, Area Reports Part 35, La. Section 2, County Data.

the number of farms in the state decreased by 42 per cent while the average size of the farms increased by 111 acres, an 82 per cent increase (The Louisiana Economy, Vol. VI, No. 4, May, 1973). Farm size in the coastal zone as shown in Fig. 3.11 has increased from 126 acres in 1954 to 256 acres in 1969, an increase of more than 100 per cent. This drastic change in size of farms has occurred also in the noncoastal area, whereas in 1954 the average farm was 94 acres, it increased to 220 in 1969. This change in size of farms may be attributable to the fact that farming today demands more mechanization and technology and the less efficient small farm is no longer economically feasible.

In summation, agriculture in the coastal zone is slowly declining in terms of numbers of acres, but the size of the farm is rapidly increasing.

D. Fisheries

1. Fish and Shellfish

Total production of fish and shellfish is increasing in Louisiana (Figs. 3.12 and 3.13). Currently, Louisiana is producing slightly more than a billion pounds of fisheries products annually, with menhaden contributing the bulk of the poundage. Menhaden is an industrial fish processed for oil and meal, which is used as protein supplements in animal food. Menhaden, a relatively recent addition to our fisheries harvest, accounts for most of the increased production.

The production of shellfish (primarily oysters and shrimp) has remained relatively constant over the past 30 years (Fig. 3.12), averaging about 100 million pounds annually. During this time, however, changes have occurred so that sustained production now requires greater harvesting effort, time and space.

2. Oysters

Oyster production varies from year to year but, for 30 years, the annual yield of oyster meat has been about 8 million or 9 million pounds. However, the acreage used for this production has increased from 19,767 acres in 1945 to 161,162 acres in 1973. This eightfold increase in acres of oyster leases to produce the same crop that 19,767 acres produced in 1945 is reflected in Fig. 3.14.

AVERAGE SIZE OF FARM
IN LOUISIANA'S COASTAL ZONE AND NONCOASTAL AREA
1954, 1959, 1964 and 1969 IN ACRES

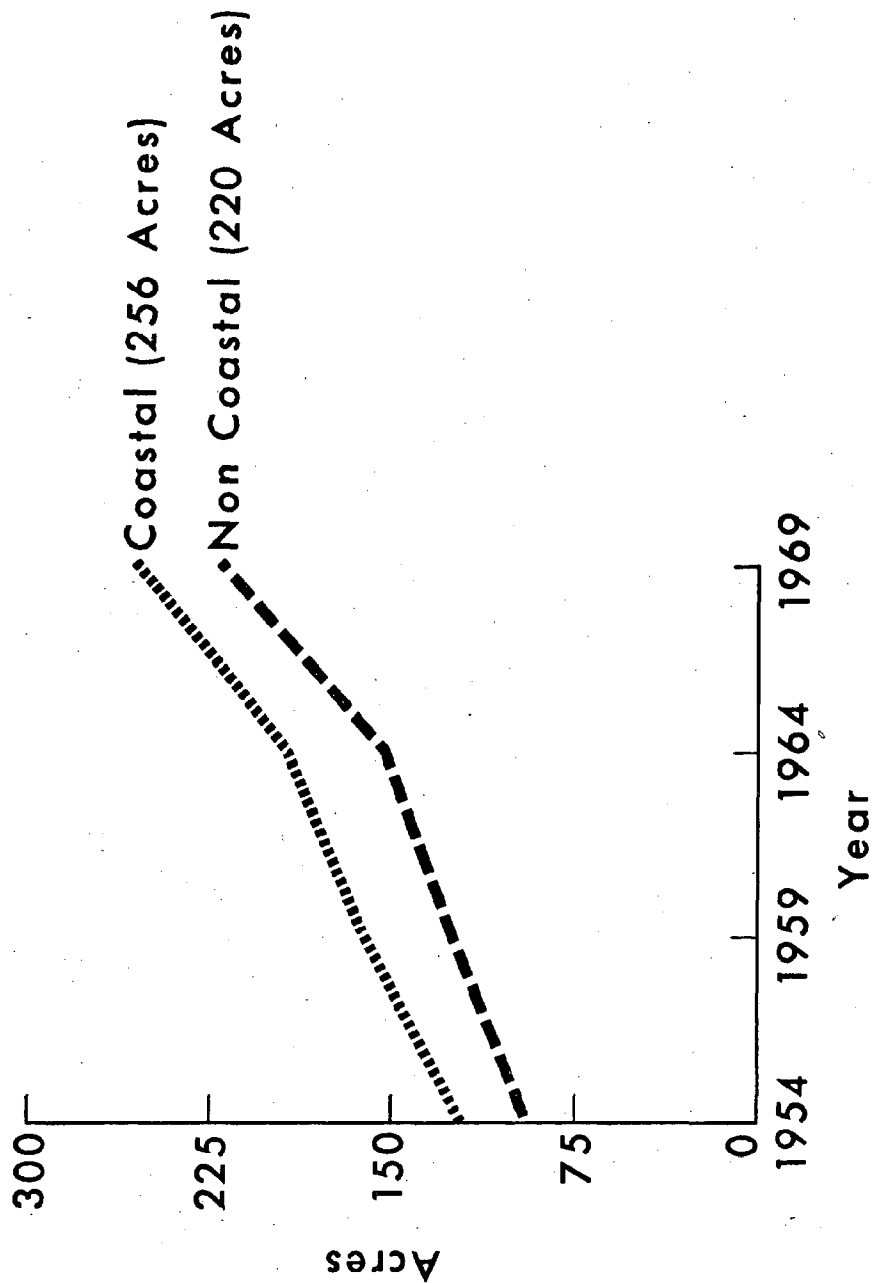


Fig. 3.11 Source: Table 3, U.S. Bureau of the Census, Census of Agriculture, 1969, Volume 1, Area Reports Part 35, La. Section 2 County Data.

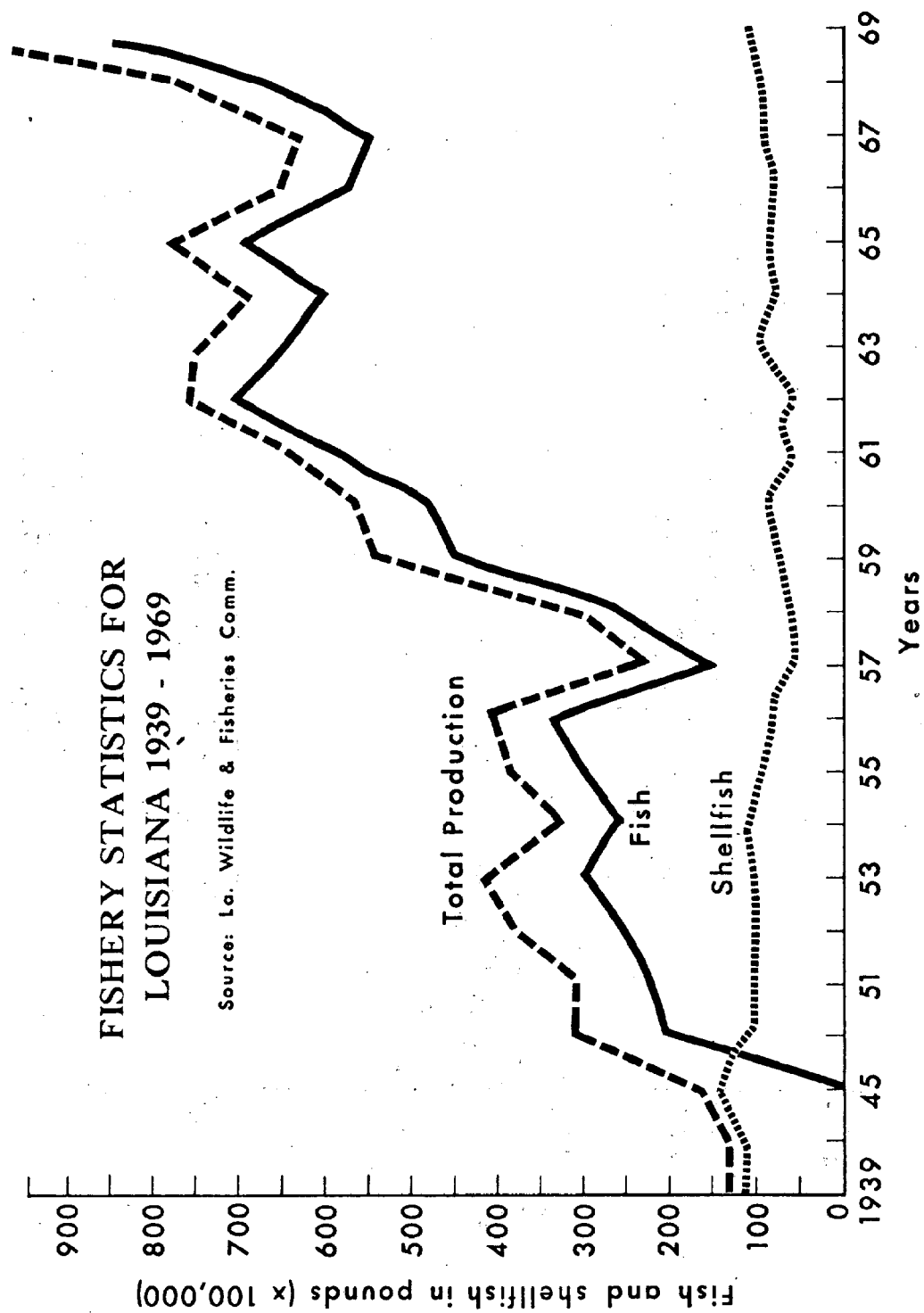


Fig. 3.12

CATCH AND VALUE OF ALL FISHERY PRODUCTS LOUISIANA COASTAL ZONE

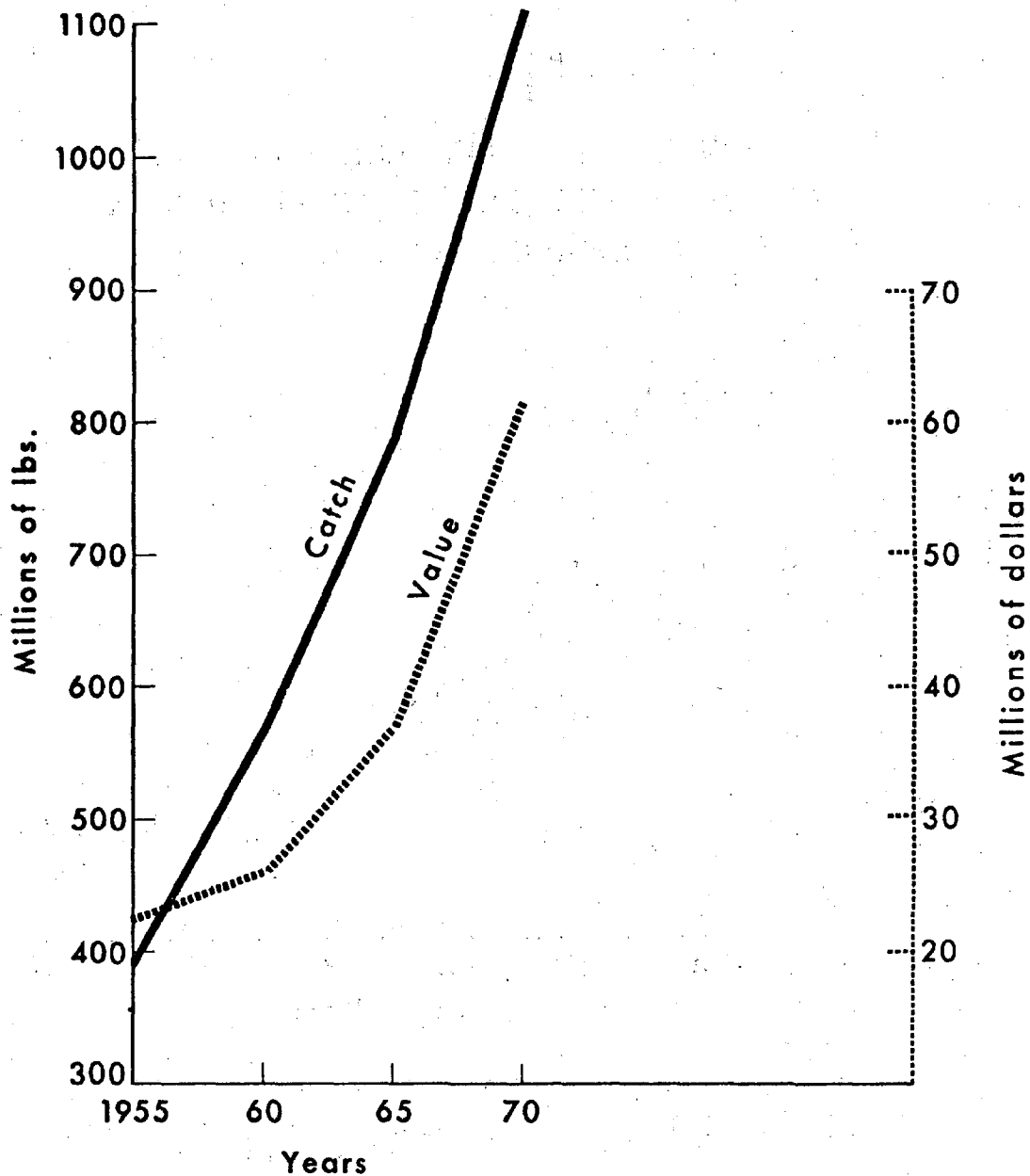


Fig. 3.13

Note: Read catch figures on left scale, value figures on right.

Source: Fisheries Statistics of the U.S., 1972; National Marine Fisheries Service.

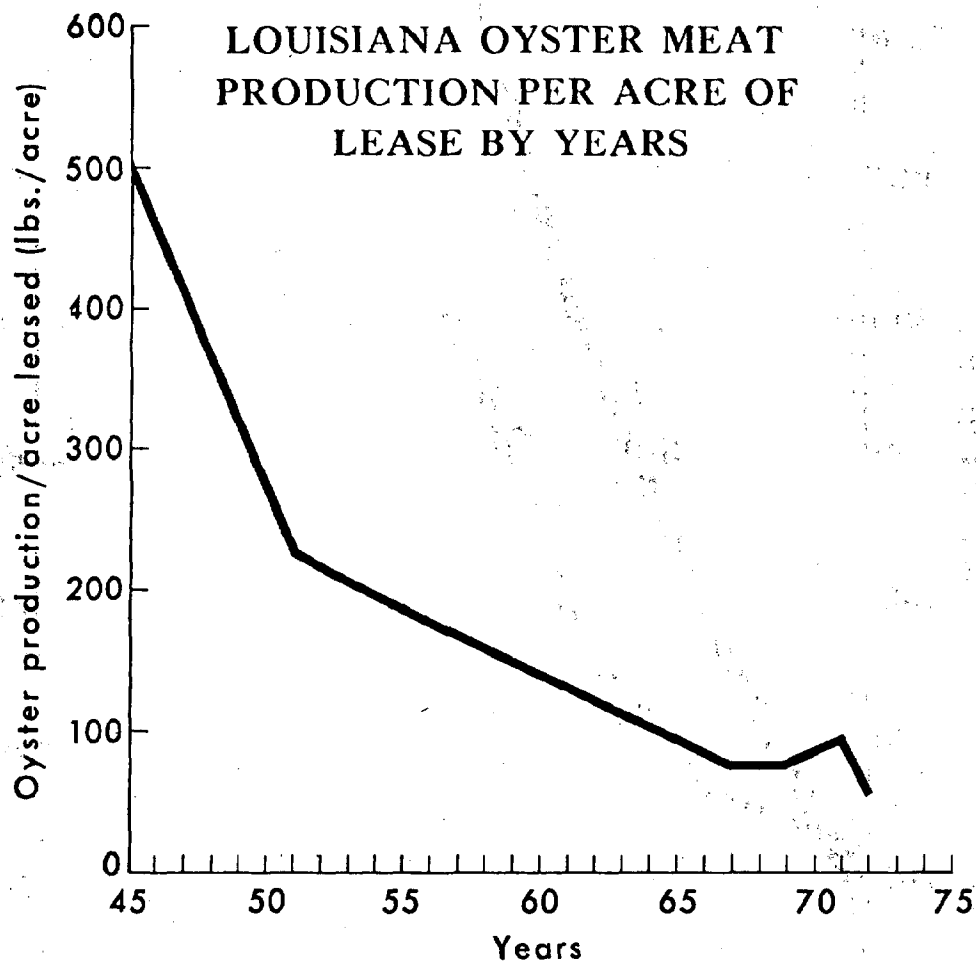


Fig. 3.14

Source: La. Wild Life and Fisheries
Commission.

Referring to the figure, we see that oyster production per acre leased has been decreasing for at least 28 years. In 1945, almost 500 pounds of oyster meats were produced per acre but in 1973 only about 50 pounds per acre are being produced. This is a tenfold reduction in production per acre. The causes of the drop in production are difficult to pinpoint but probably are the results of: (1) changes in types of production, from intensive to extensive, (2) competition for space with activities of the mineral extraction agencies, (3) saltwater intrusion, which brings the oyster drill, a predator, and (4) increasing urbanization and its sewage and solid waste.

Increasing acreages of potential oyster-producing water-bottoms are being closed each year by the Louisiana Health Department because of excessive bacterial concentrations in the waters. These bacteria, commonly called fecal coliform, indicate the extent of (domestic) pollution and result in prohibitions against the taking of oysters if the number of coliform per unit volume of water exceeds a certain standard.

As urbanization and its sewage increase in wetland areas we can expect more bacterial pollution and the contamination of previously unpolluted acreages. This trend is shown on Fig. 3.15. Data were provided by the Louisiana Health Department.

Louisiana Wild Life and Fisheries Commission data indicate that of 160,000 acres of state waterbottoms leased for oyster production, 41,710 acres, or 26 per cent, are now closed to harvesting because of sewage pollution.

In summation, the oyster industry is literally being squeezed out between urban pollution on the landward side and the conch line (saltwater line) on the seaward side.

3. Shrimp

Shrimp production, though variable, has averaged about 80 million to 90 million pounds annually since the late '30s. In Fig. 3.16, trends are presented for recent Louisiana shrimp catches, the value of the catch, and the percentage of the total national catch of shrimp represented by the state's catch. Pounds and value are showing healthy growth, and it is anticipated that with careful management, such growth can continue for at least several years. Although production of shrimp has been increasing lately, fishing effort, as measured by the number of licensed trawls, has increased sevenfold since 1945. This relatively constant total shrimp production and increasing catch effort result in a lower catch per boat (Fig. 3.17).

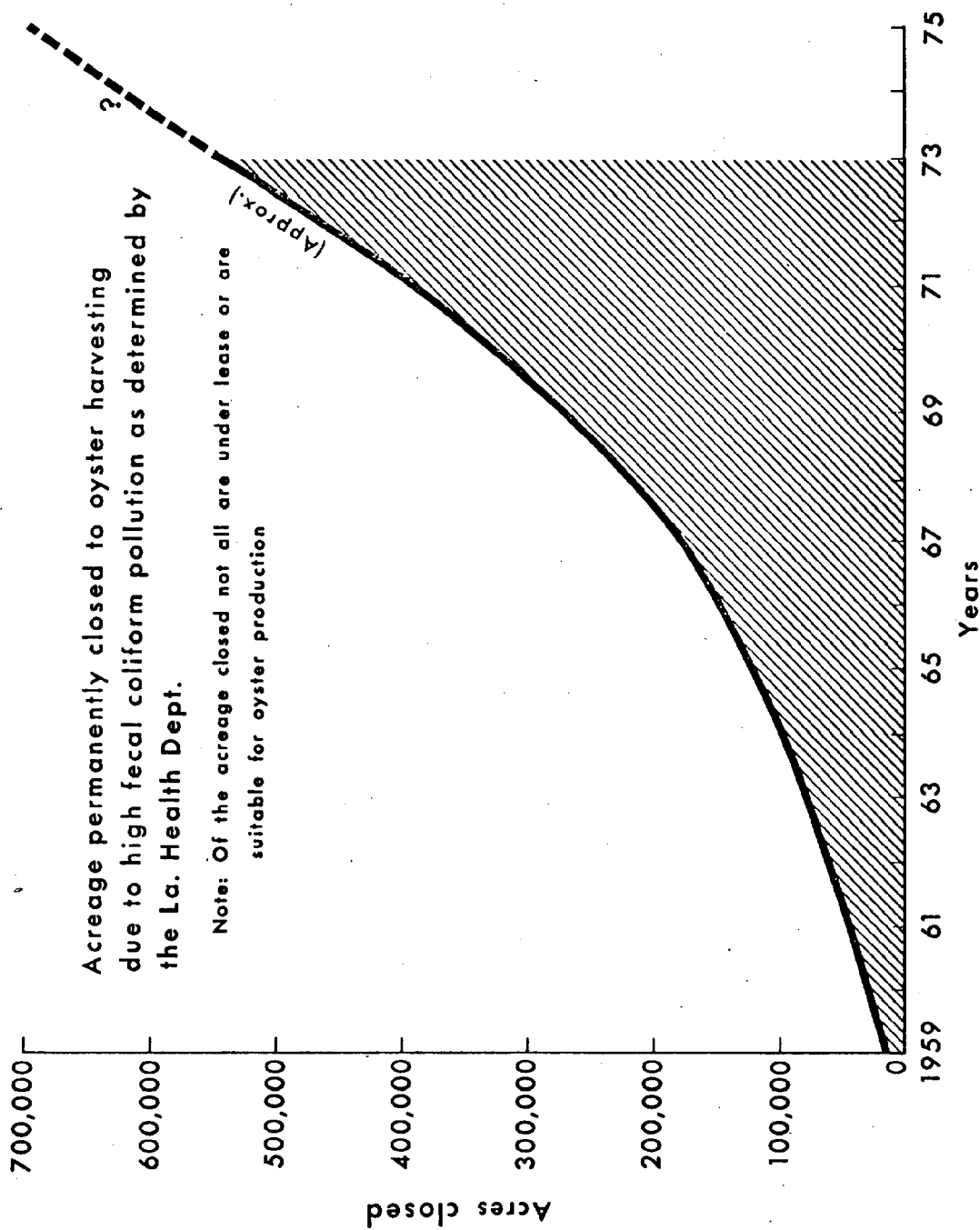


Fig. 3.15 - ACREAGES PERMANENTLY CLOSED TO OYSTER HARVESTING DUE TO FECAL COLIFORM POLLUTION AS DETERMINED BY THE LOUISIANA HEALTH DEPARTMENT.

LOUISIANA SHRIMP CATCH , 1966-70

Pounds, Value and Per Cent
of Total U.S. Catch

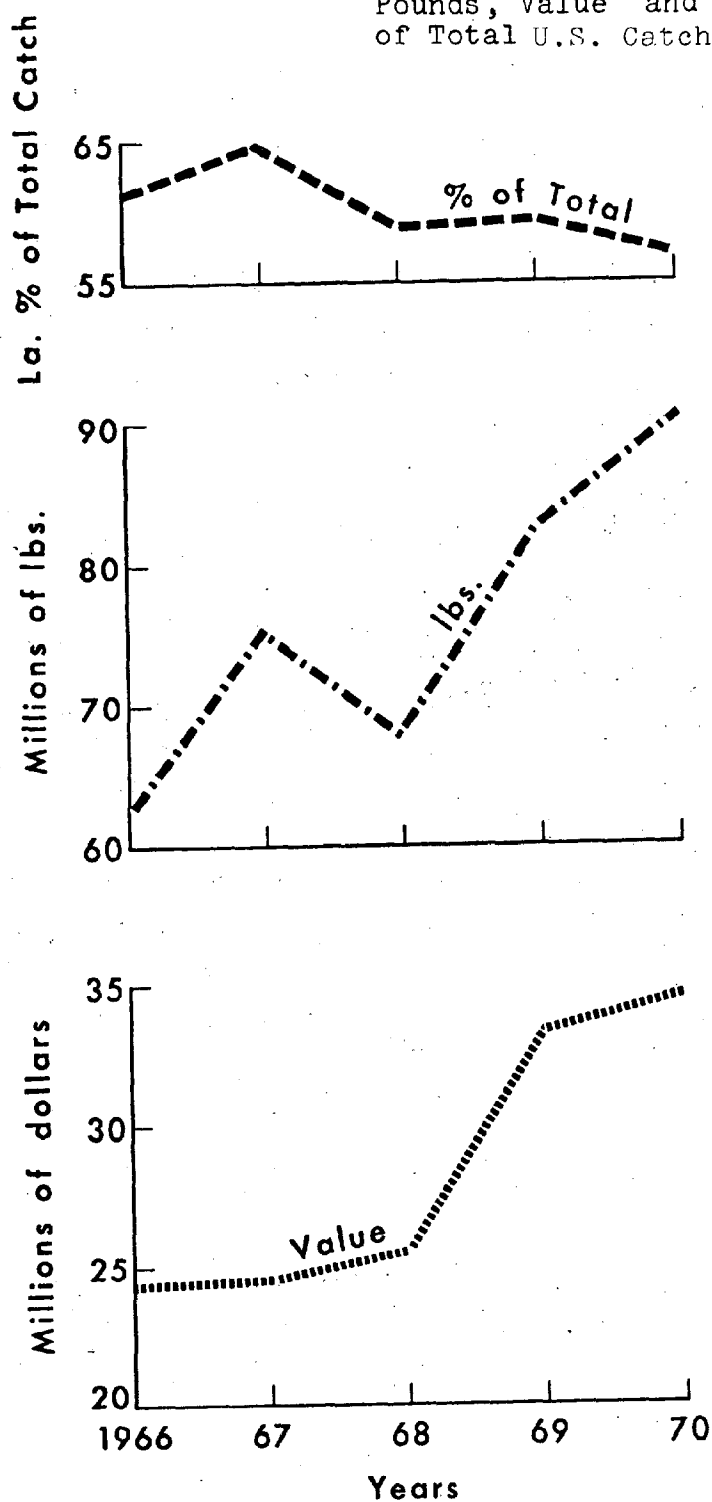


Fig. 3.16

Source: U.S. Department of Commerce
and Louisiana Wild Life
and Fisheries Commission,
1966-1970, Louisiana Landings

ANNUAL SHRIMP PRODUCTION (CATCH) PER LOUISIANA BOAT BY YEARS

Source: La. Wildlife & Fisheries Comm.

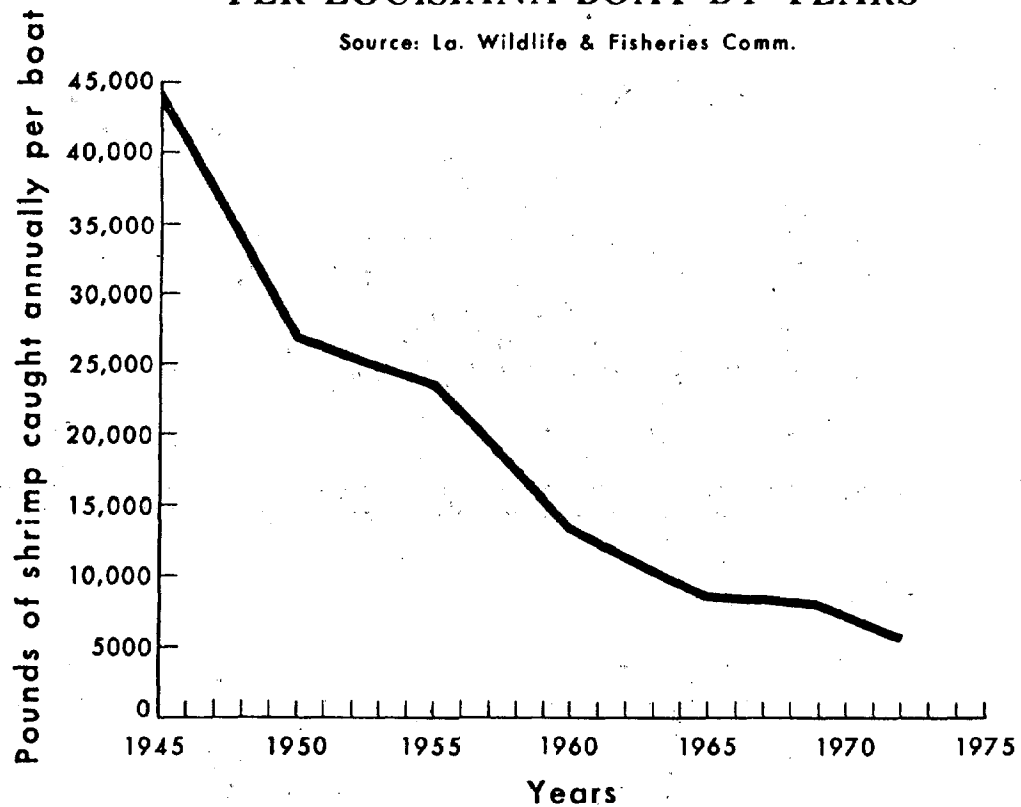


Fig. 3.17

Source: Louisiana Wild Life and
Fisheries Commission

In 1945, each shrimp boat had an annual haul of about 44,000 pounds of shrimp but by 1972 the catch per boat had been reduced to an annual haul of about 5,750 pounds, an eightfold reduction. The value of the shrimp catch has increased over the years so that the shrimp fishing can now support a greater number of boats.

II. Economic Trends in the Coastal Zone

Though it is risky to generalize to a great extent from trend data, frequently such data can indicate the areas of strengths and weaknesses in an economy. While exercising due caution in interpreting the results of the following trends, one can note a generally healthy competitive tendency in the Coastal Zone of Louisiana.

A. Per Capita Income

Fig. 3.18 depicts the growth in real per capita income for the coastal zone, the state and the nation. The term "real" in this context means that the dollar figures have been adjusted for inflation to reflect per capita income in terms of dollars of constant purchasing power.

It may be noted that the coastal zone enjoys not only a higher level of real per capita income than does the rest of the state, but that the rate of increase is higher as well. If these trends hold true, the coastal zone will continue to widen the gap and dominate the state's economy.

While the coastal zone parishes do not enjoy a level of real per capita income as high as the national average the rate of increase is greater than the national rate of increase. If these trends remain relatively constant, it is apparent that the coastal zone real per capita income will surpass the national average in the vicinity of the year 1980.*

It is difficult to isolate sufficient data to compute real per capita income for a group of parishes not bound into a separate political entity, such as a planning district. The data upon which the coastal zone trend is based were drawn largely from the LSU-BR Business Department.

*Scott, Beard, and Duggar, LSU-BR Business Department.

REAL PER CAPITA INCOME TRENDS: COASTAL ZONE, STATE, NATION

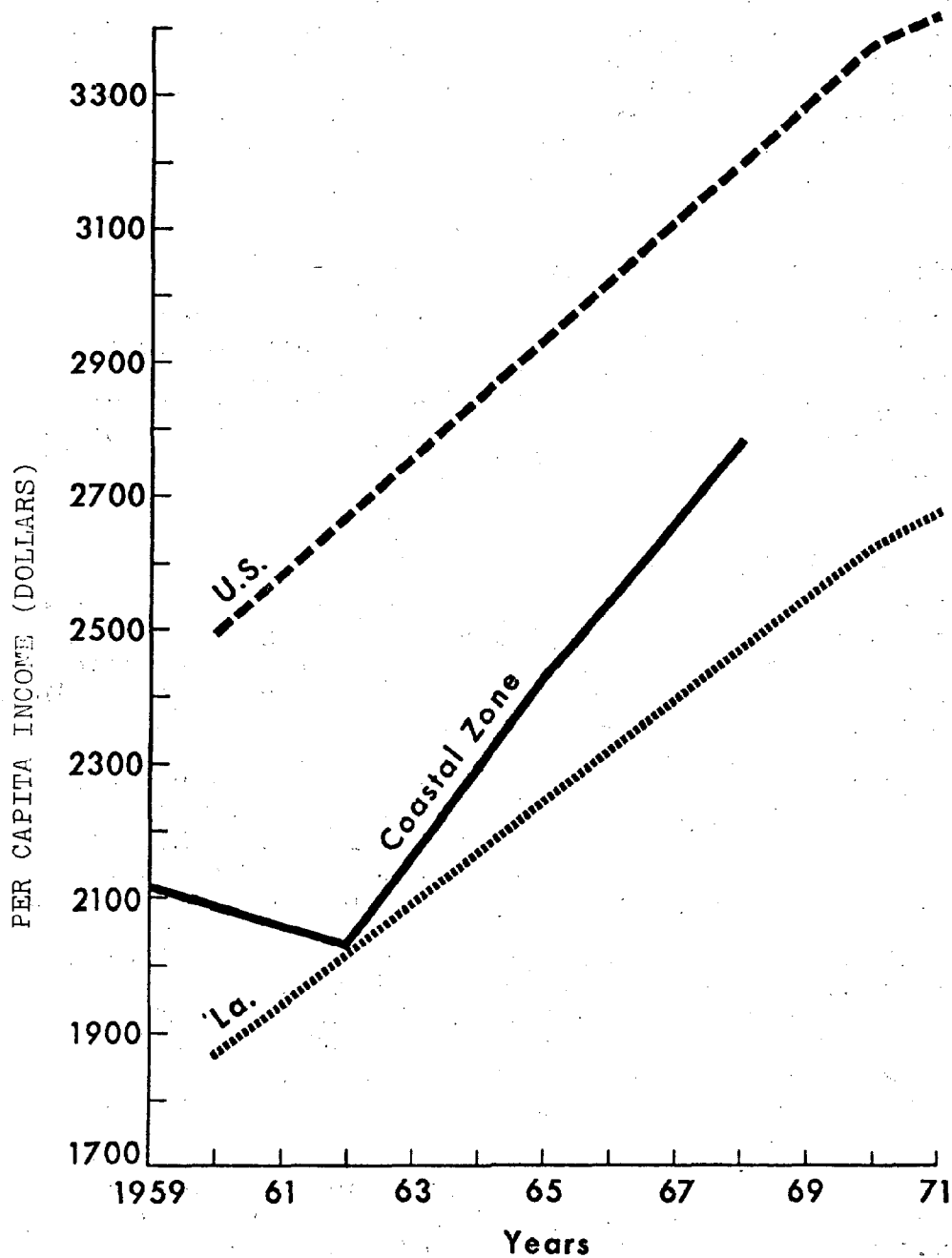


Fig. 3.18 Sources: "U.S. Statistical Abstract" (1972)
 U.S. Census
 Economic Profile and personal income
 data for LSPP's, SMSA's, and non
 SMSA's Parishes in Louisiana.
 Scott, Beard and Duggar.

B. Petroleum

Much attention is being given today to the energy crisis which faces this nation and others. Fig. 3.19 indicates that the nation's known oil reserves are dwindling at an alarming rate, which is not only steep, but increasing.

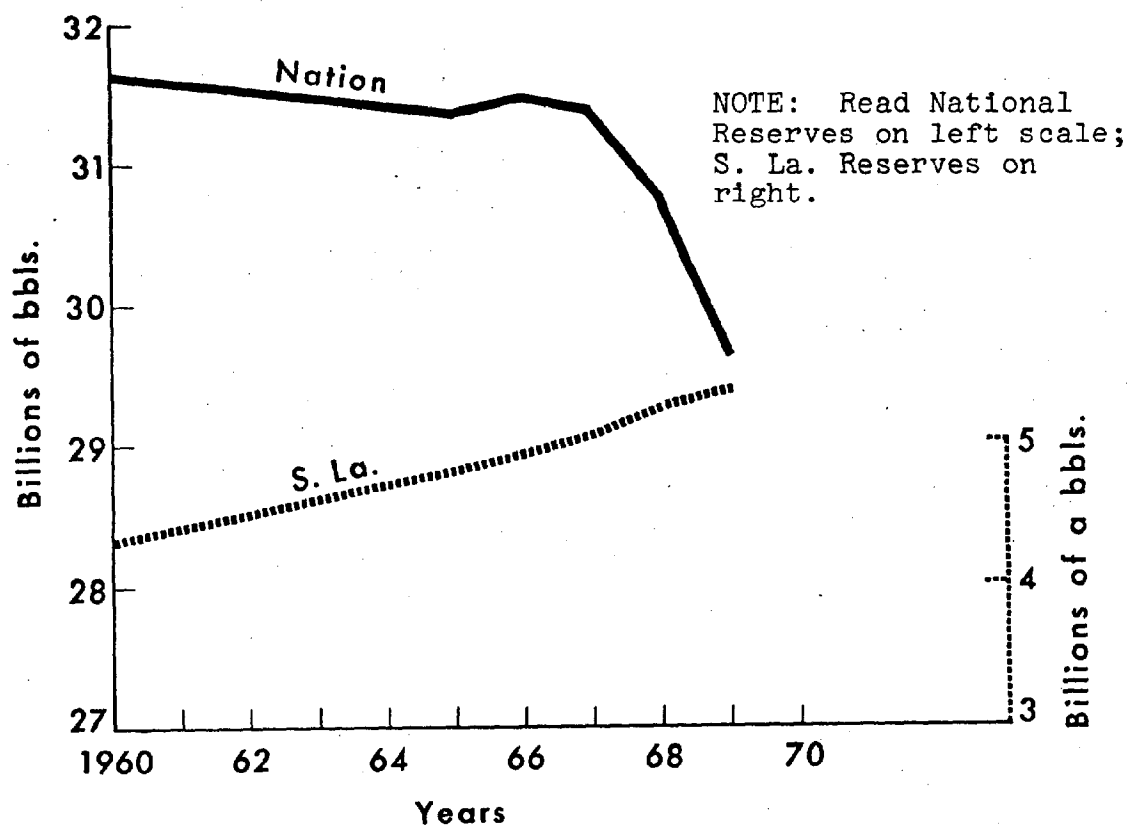
In this area of study, trends may tend to give a sense of false complacency. For the decade of the 1960s, the known oil reserves for the southern portion of Louisiana (primarily the coastal zone) increased at a fairly constant rate. However, one cannot project this reate of increase into the future because it is a recognized fact that such reserves are finite and the discovery of new reserves cannot forever outstrip the increasing rates of usage of known reserves. Nevertheless, according to 1969 data, coastal Louisiana's known reserves have not been dwindling as have those of the rest of the nation. The indication is that greater demands will be put on Louisiana's crude as a result of the oncoming national shortage, and depletion of the state's reserves will be accelerated.

Data for natural gas and natural gas liquids are presented in Fig. 3.20. In both cases, trends for southern Louisiana appear to be favorable in relation to the national trends, but again caution is urged when interpreting them because of the increased drain on Louisiana reserves as a result of the national shortage.

An indicator of what the future holds for petroleum mining in southern Louisiana may be found in Fig. 3.21. Well completions in southern Louisiana are depicted for the 1960s. The trend is fewer completed wells yielding oil each year, and a slightly higher number of dry wells each year. Wells yielding gas appear to be fairly constant in number but, after an upsurge in the late 1960s, a leveling off is evident and consumption is still increasing at a rapid rate.

Fig. 3.22 indicates the extent to which the prosperity of the coastal zone of Louisiana is related to the health of the petroleum industry. The number of jobs in petroleum-related industries has been increasing constantly. A leveling-off of oil production, and the attendant decline in jobs, would result in the reversal of this strong upward trend, with ill effects for the economy of the coastal zone. To date, it appears likely that the oil industry will be bolstered by the construction of a superport in the Gulf and that such bolstering will be economically advantageous to the coastal zone.

CRUDE OIL RESERVES, U.S. AND SOUTH LOUISIANA



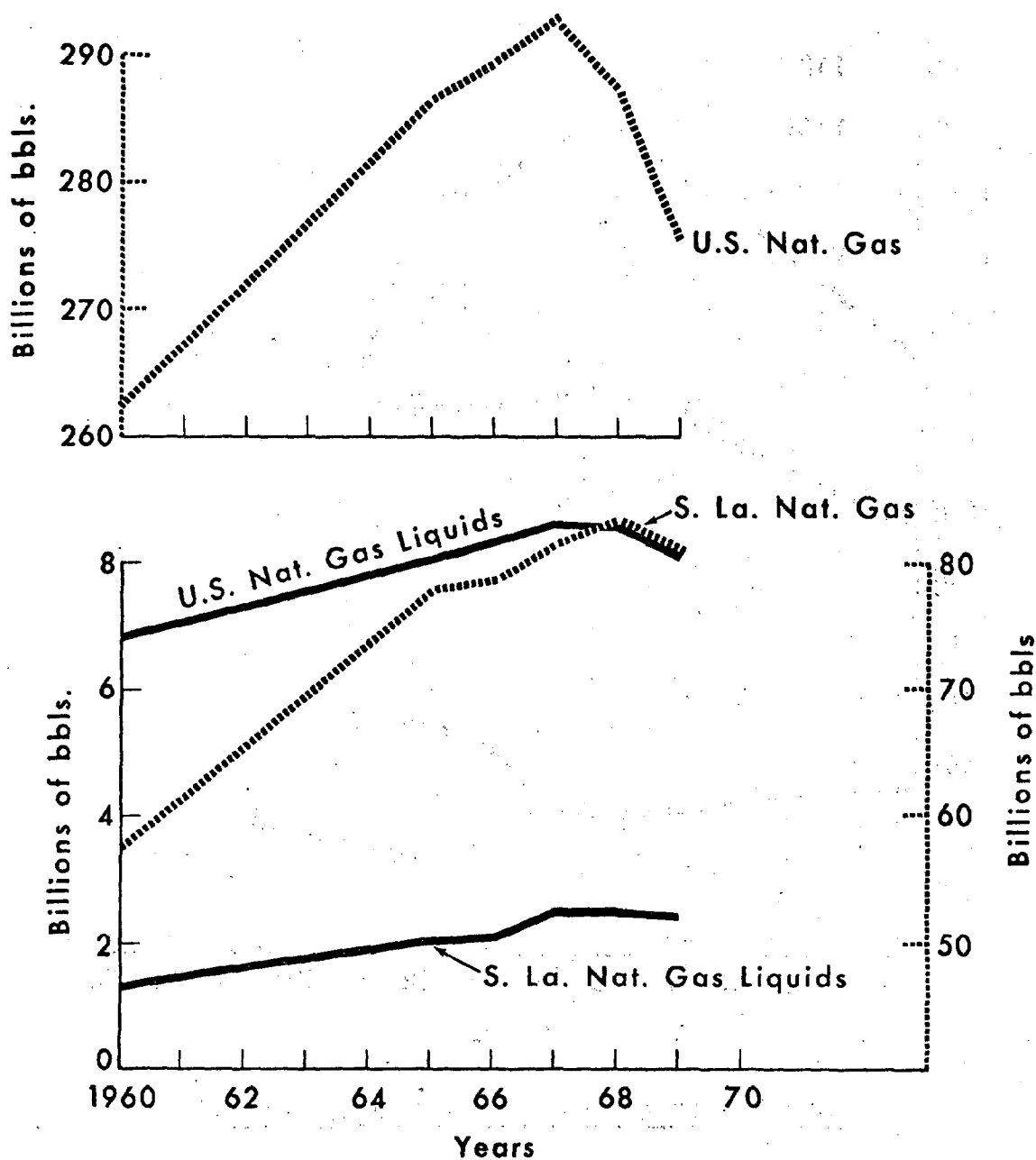
	1960	1965	1966	1967	1968	1969
U.S.	31.6	31.4	31.5	31.4	30.7	29.6
S.La.	4.4	4.8	4.9	5.1	5.2	5.4

(Figures Rounded) Full data p. 88, Jones-Rice.

Fig. 3.19

Source: Amer. Pet. Inst., 1970, Reserves of Crude Oil, Natural Gas Liquids, and Natural Gas in the U.S. and Canada and U.S. Productive Capacity as of Dec. 31, 1969. Vol. 24.

GAS RESERVES, U.S. AND SOUTH LOUISIANA

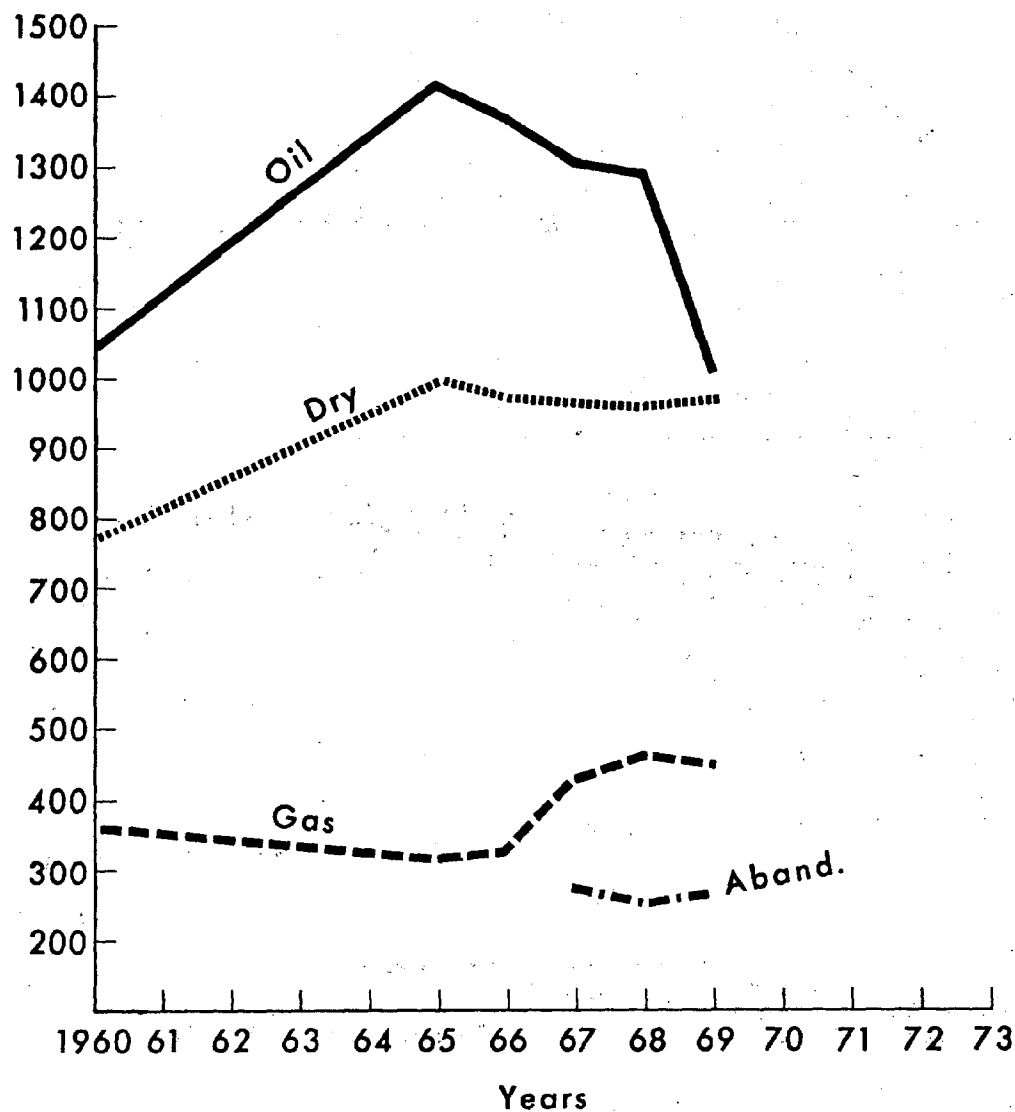


NOTE: Read solid lines on solid axis, dashed lines on dashed axis.

Fig. 3.20

Source: Amer. Pet. Inst. (1970) "Reserves of Crude Oil, Nat. Gas Liquids, and Nat. Gas in the U.S. and Canada and U.S. Production Capacity as of Dec. 31, 1969, Vol. 24.

SOUTH LOUISIANA WELL COMPLETIONS, 1960-69



SOUTH LOUISIANA WELL COMPLETIONS, 1960-69

	1960	1965	1966	1967	1968	1969
Oil	1045	1418	1370	1302	1289	1007
Gas	364	312	329	431	462	449
Dry	778	992	992	966	961	974
Abandoned	-	-	-	277	257	270

Fig. 3.21

Source: Ira Rinehart's Oil and Gas Yearbook, Drilling Summaries, 1970, 1967, 1961. Rinehart Oil News Company. Dallas.

PETROLEUM-RELATED EMPLOYMENT IN THE COASTAL ZONE PARISHES

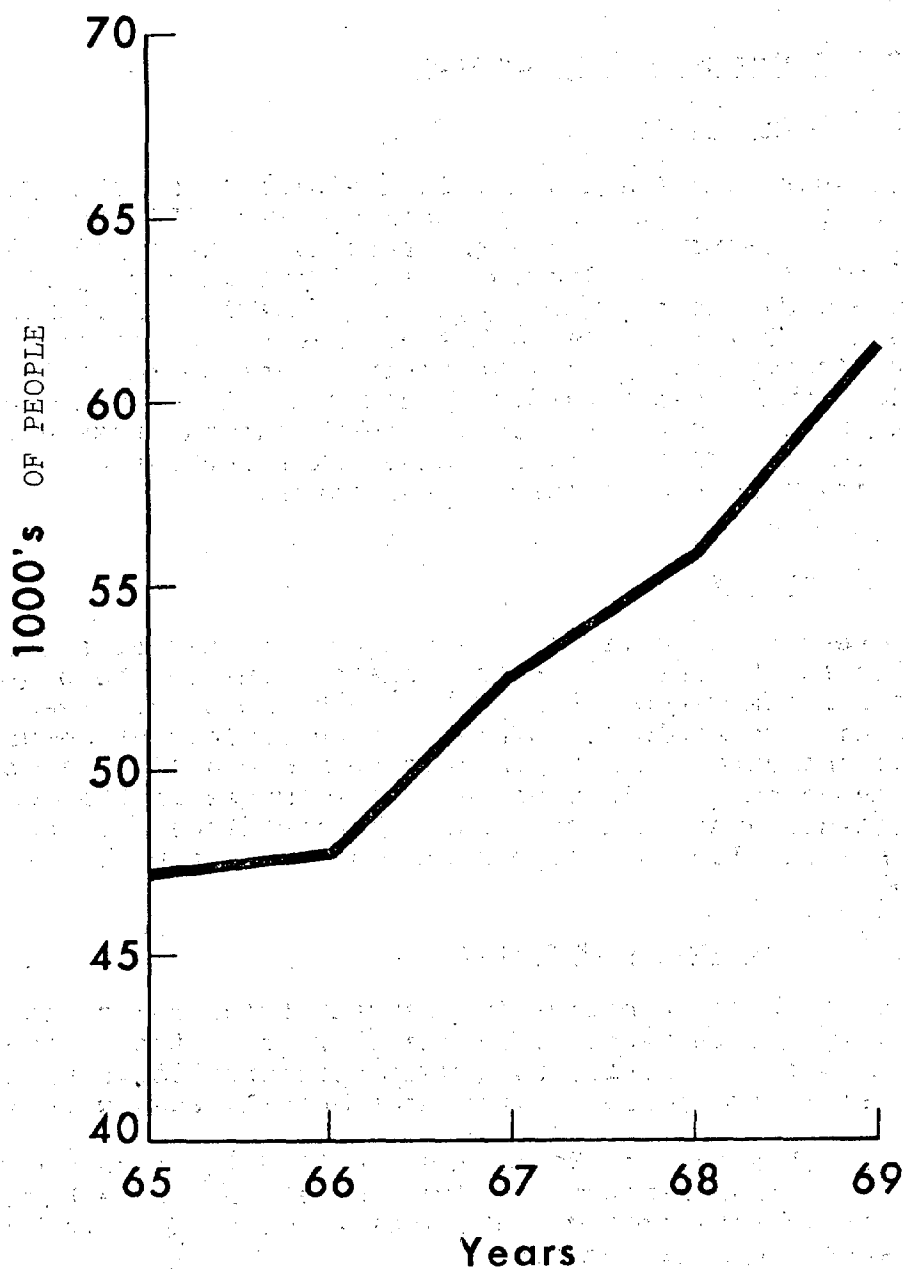


Fig. 3.22 Source: Lamar B. Jones and G. Randolph Rice, An Economic Base Study of Coastal Louisiana, Center for Wetland Resources, LSU-BR, 1972.

In summation, the economy of the coastal zone appears to be in good health currently and to offer viable opportunities for increased economic vigor.

C. Commerce and Industry

1. Investment

Industrial investments in Louisiana's coastal zone are on the rise. After a rapid decrease from 1956 to 1959, annual investments increased steadily to their 1972 level of \$730 million. This increase is evident in Fig. 3.23. Over the past decade, the increase in industrial investment in the coastal zone parishes has been more than fivefold. For comparison, industrial investment in the noncoastal zone parishes has been included. Industrial investment in the coastal zone is considerably higher than the remainder of the state and is on the increase while decreasing or becoming static elsewhere in the state.

2. Wages

Perhaps a better indication of more direct effects of commerce and industry on the coastal zone can be obtained by observing wages. Fig. 3.24 shows the total wages of coastal zone employees covered by the Employment Security Law, contrasted with wages paid to noncoastal zone employees, also covered. As is expected, total wages in the coastal zone are higher and are increasing. The remainder of the state is increasing also, but more slowly and with a much lower wage total.

3. Waterborne Commerce

Waterborne commerce in coastal Louisiana is increasing at a rapid rate, too. The coastal zone is the setting for the majority of Louisiana's water transportation activities and is the crossroads of the most heavily used waterways.

The Mississippi River and the Gulf Intracoastal Waterway (GIWW) are major waterways for the nation's waterborne commerce. They traverse the coastal zone of Louisiana and intersect near New Orleans.

Fig. 3.25 shows the ton-miles of cargo carried by each of these waterways yearly from 1954 through 1971. During this period, traffic on the lower Mississippi River and GIWW has increased threefold. The data represent traffic

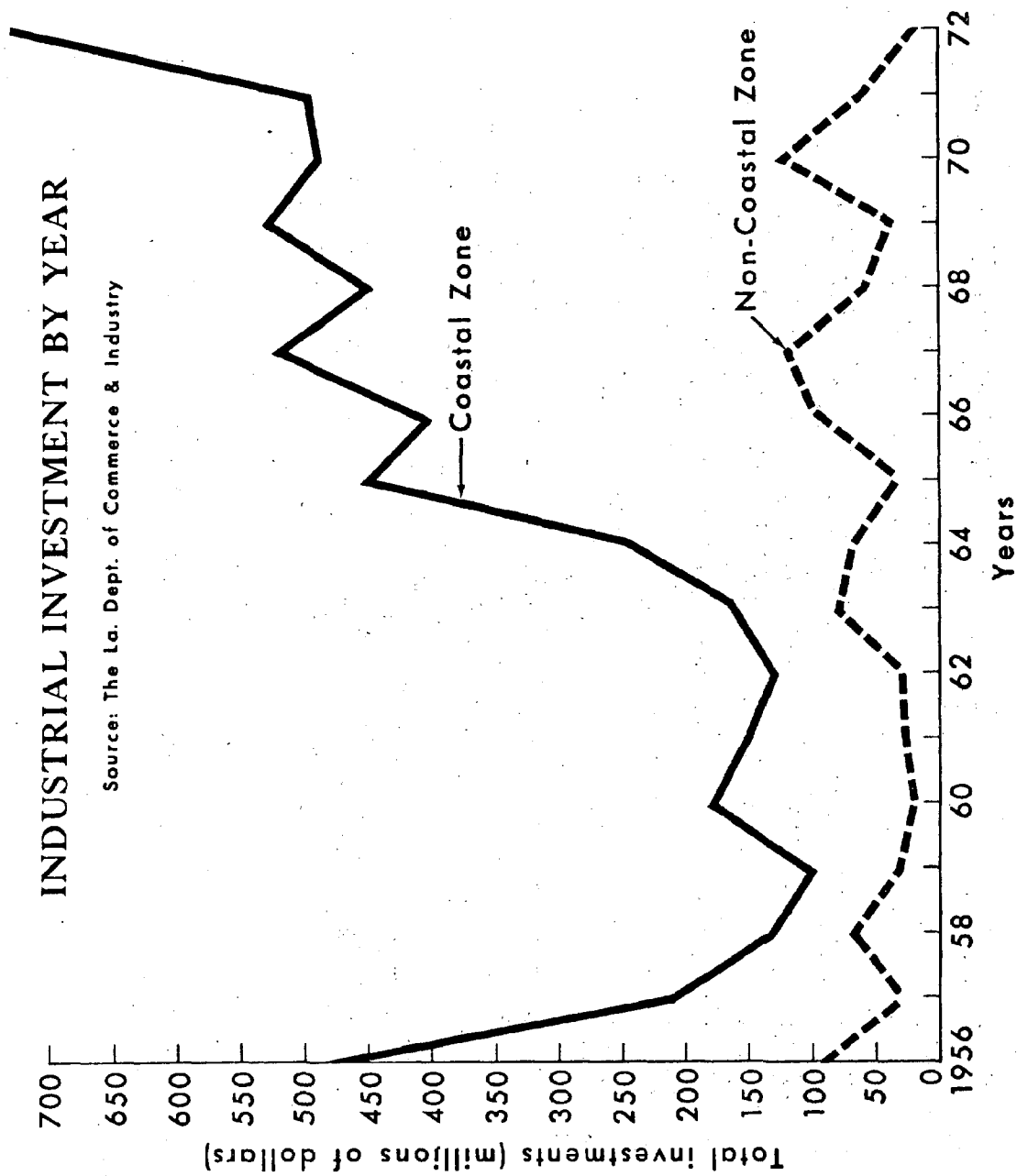


Fig. 3.23 Source: The Louisiana Department of Commerce and Industry

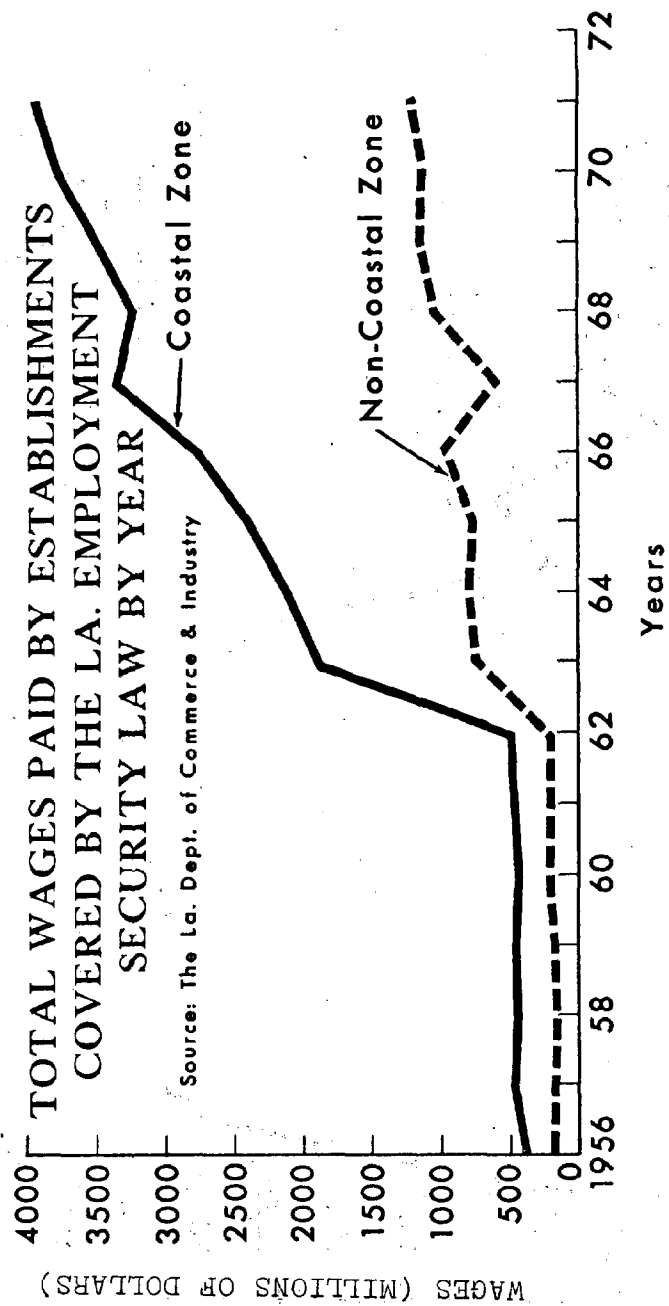


Fig. 3.24 Source: Louisiana Department of Employment Security.

TON MILES PER YEAR ON THE TWO MAJOR WATERWAYS IN COASTAL LOUISIANA

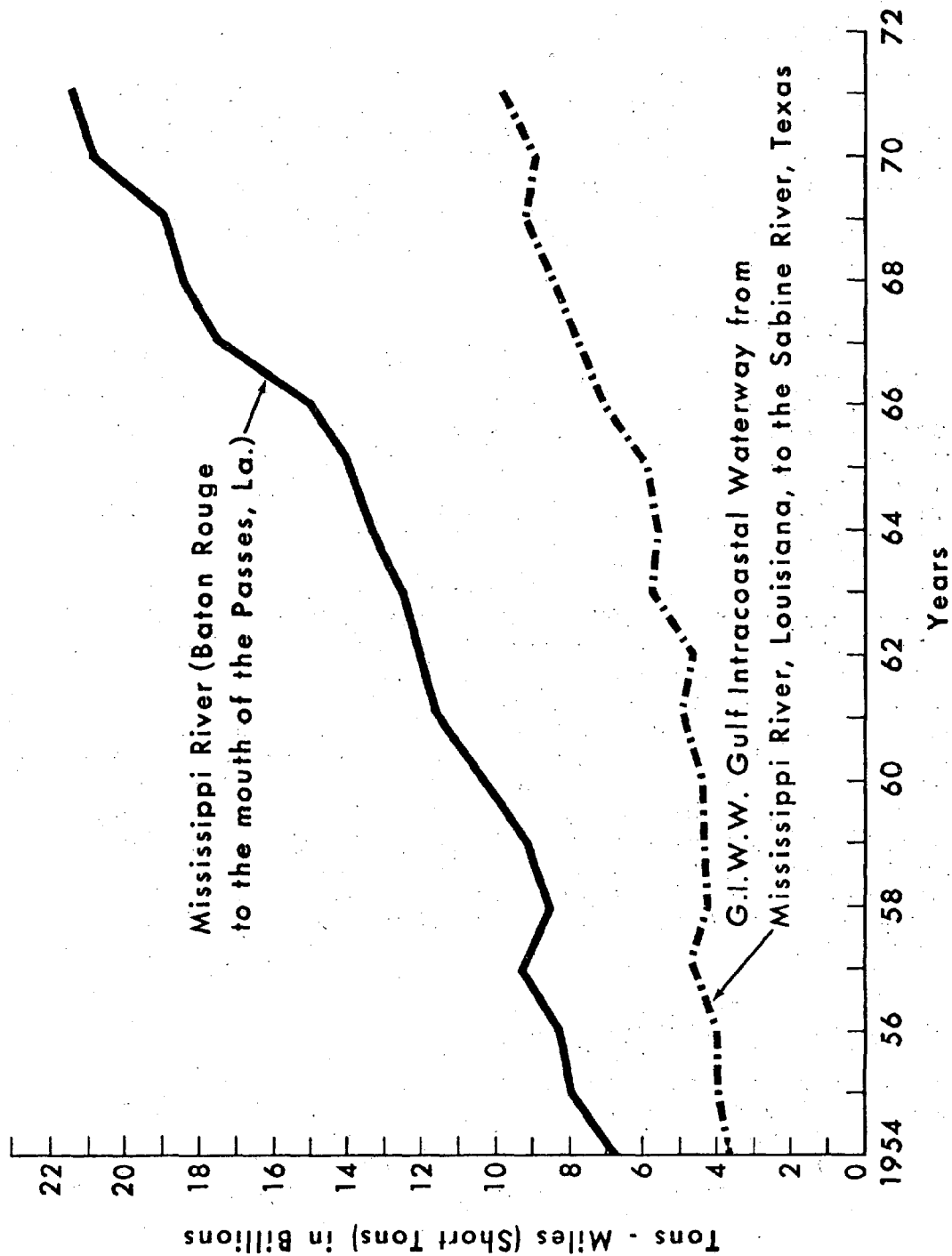


Fig. 3.25 SOURCE: Waterborne Commerce of the United States, Part 2, Department of the Army Corps of Engineers, Calendar Years 1954-1972.

on that portion of the river from Baton Rouge to Mouth of Passes and the portion of GIWW from its intersection with the Mississippi river, west to the Texas-Louisiana border.

III. The Changing Coastal Zone

Louisiana's coastal zone is a dynamic, everchanging system. In the past, the changes were evolutionary and driven by forces of nature. Increasingly, in the past century, changes in the coastal zone have been wrought by man's activities. Some indication of the magnitude of these changes can be obtained by examining flood control and navigation expenditures, salinity changes and land loss.

A. Construction

By their very nature, flood control and navigation construction cause changes in the coastal zone. Construction activity is designed to change the natural system so that man can make use of it. Although man derives benefit from the changes in the ecosystem, and although the effect of construction activity on the natural system varies from project to project, few will deny that changes do occur.

It is difficult to determine the magnitude of change resulting from construction in the coastal zone without exhaustive studies on each project. In general, these studies do not exist; thus other indicators of change must be used. One of these indicators is expenditures (or appropriations) for construction activities in the coastal zone. Fig. 3.26 shows congressional appropriations over the past 10 years for flood control and navigation in the coastal zone. The appropriations were made to the U.S. Army Corps of Engineers, whose job it is to carry out the construction. The graph indicates that construction activity was relatively constant or slightly decreasing from 1964 through 1970 and has increased threefold from 1970 to 1973.

B. Saltwater Intrusion

Saltwater intrusion occurs when saline ocean waters intrude into previously freshwater areas. When this happens, the vegetation and wildlife, which have adapted to freshwater conditions, die or escape. This causes an impact in the biological system and productivity is adversely affected.

CONGRESSIONAL APPROPRIATIONS FOR CONSTRUCTION
BY THE U.S. ARMY CORPS OF ENGINEERS IN LOUISIANA'S COASTAL ZONE
FOR FLOOD CONTROL AND NAVIGATION

(Excludes Maintenance Costs in the Coastal Zone and the Mississippi River and Tributaries)

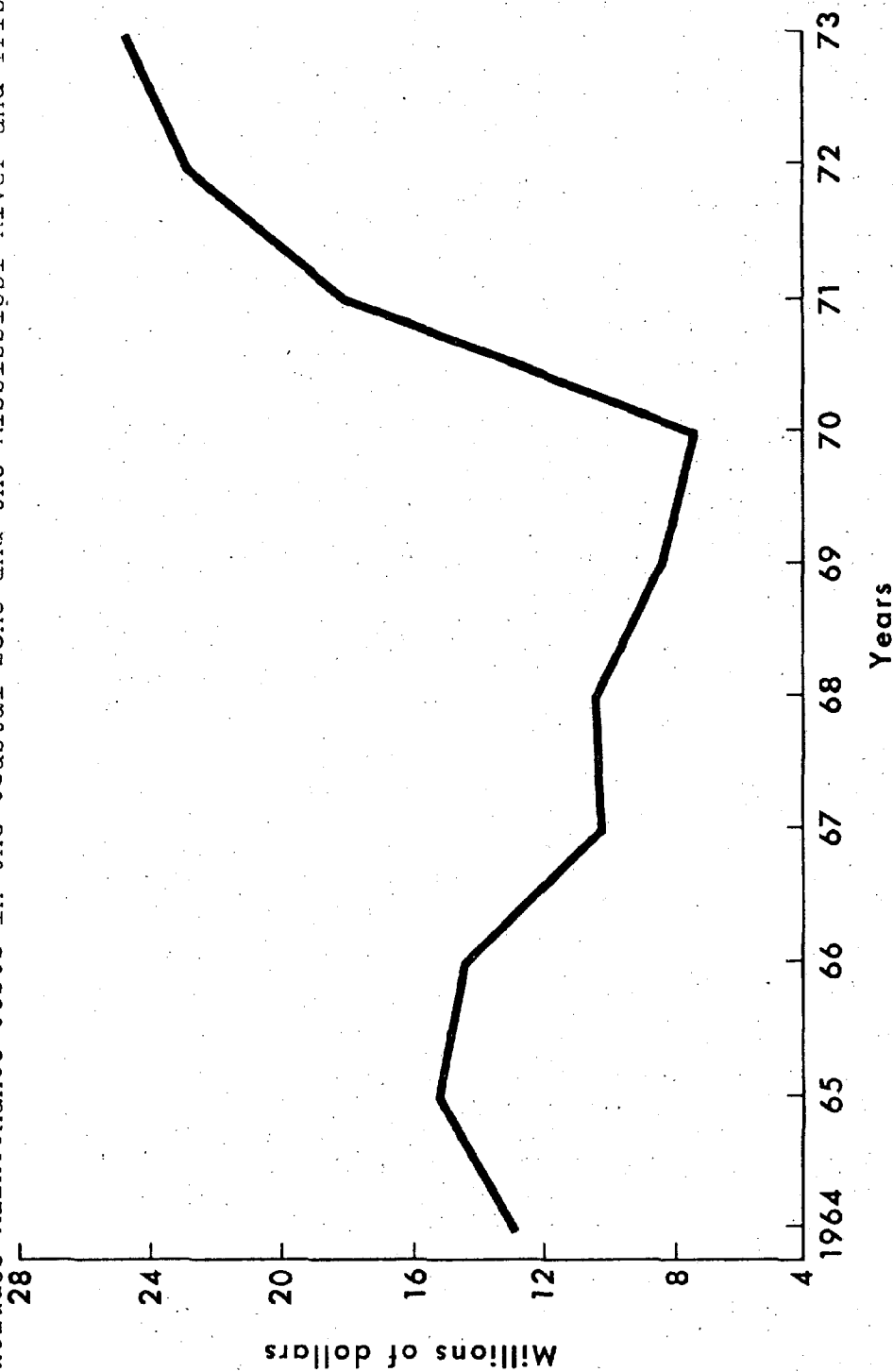


Fig. 3.26 Source: Annual Report of Chief of Engineers. U.S. Army On Civil Works Activities, Extract Reports Upon Improvements in New Orleans Louisiana District.

The reasons for increasing saltwater intrusion are many: fresh water shortage resulting from extensive flood control works (levees, for example), increased canalization and channelization (which serves as a conduit for seawater), erosion and loss of barrier islands or beaches. The pattern of saltwater intrusion is fingerlike in that seawater intrudes up channels, natural or manmade, where the flow of freshwater from the landward side is low.

The data concerning increasing salinities are incomplete in most areas of the state but some existing data clearly indicate a trend of increasing saltwater intrusion into selected areas. To be complete, salinity data must be collected frequently over many years, because salinity variations within a single year can easily exceed variations from year to year.

Observations of dying cypress trees in Lake Pontchartrain in St. John the Baptist Parish and along the Houma Navigation Canal and adjoining Falgout Canal have been attributed to increasing salinities. Cypress trees are good biological indicators of changing salinities because they begin to die in salinities of one-to-two parts per thousand (ppt).

Another good biological indicator of salinity concentrations and patterns is the "conch" (oyster drill), a deadly predator of oysters. The conch prefers saltier waters and generally is not found in waters which have less than 15 ppt (parts per thousand) salt. The "conch line" (the line which separates fresh and salt water into fresher than 15 ppt or saltier than 15 ppt) can then be drawn by determining salt concentrations in a waterbody. Generally this results in a lateral line drawn across a waterbody which shows the limit of the conch's intrusion into fresher areas. Toward the fresher or landward side of the line, there will be no conchs; toward the seaward side of the line, there are conchs present and oysters cannot be raised year-round in this area.

Data collected on the conch line in Barataria Bay in 1937 indicates that the line was about four miles north of Grand Isle and roughly parallel to it. Recent data (1972) shows the conch line (15 ppt salinity line) to have moved northward toward land some four miles all across Barataria Bay. This represents a significant loss of over 2 million acres of potential oyster producing water bottoms.

Saltwater intrusion has also been observed in the freshwater areas which Houma uses as a source of drinking water, and in the Vermilion river when flow is low and pumpage from the river is high, as in late summer.

Louisiana Wild Life and Fisheries Commission data indicate that mean salinities in Lake Pontchartrain have increased from yearly averages of 1-to-3 ppt in the early '60s to the current yearly averages of 4-to-9 ppt.

Figs. 3.27 and 3.28 show the trends of increasing average salinities at three points in Orleans and St. Bernard Parish near the Mississippi River Gulf Outlet. These are the only points along the coast where reliable, long-term data are available.

C. Land Loss

In the past, new land built by deposition of river sediments more than offset land lost through erosion; however, this is no longer the case. Recent studies at LSU BR have demonstrated that, in fact, a yearly net loss of 16.5 square miles of land (Fig. 3.29) occurs through shoreline erosion, marsh deterioration, canal construction and other factors. The studies show that the diminution has occurred at least since 1940 for a total loss of about 500 square miles. This represents about one half the total area of the state of Rhode Island.

IV. Conclusion

The coastal zone is the scene of intense and ever-expanding human activity. Population is rapidly increasing, becoming more urban and affluent. Activities all across the economic sector are accelerating as evidenced by trends of wages, investments and general commerce. Increased population and higher incomes will increase demands for recreation and products of fisheries, agriculture and industry. In short, all resources of the coastal zone, renewable and nonrenewable, will be utilized even more intensively than they are now.

However, indications are that, even at the present level of resource use, some undesirable effects are occurring. Saltwater intrusion, land and habitat loss, pollution of recreation and shellfish producing waters, and probable reduction of potential shellfish production are all signs of highly stressed resources. Undoubtedly the stresses will increase unless a management system is devised to minimize stresses and impacts resulting from use of resources.

SALINITIES FROM THREE STATIONS IN THE
GENERAL VICINITY OF THE BAYOU BIENVENUE-
BAYOU MERCIER STUDY AREA.

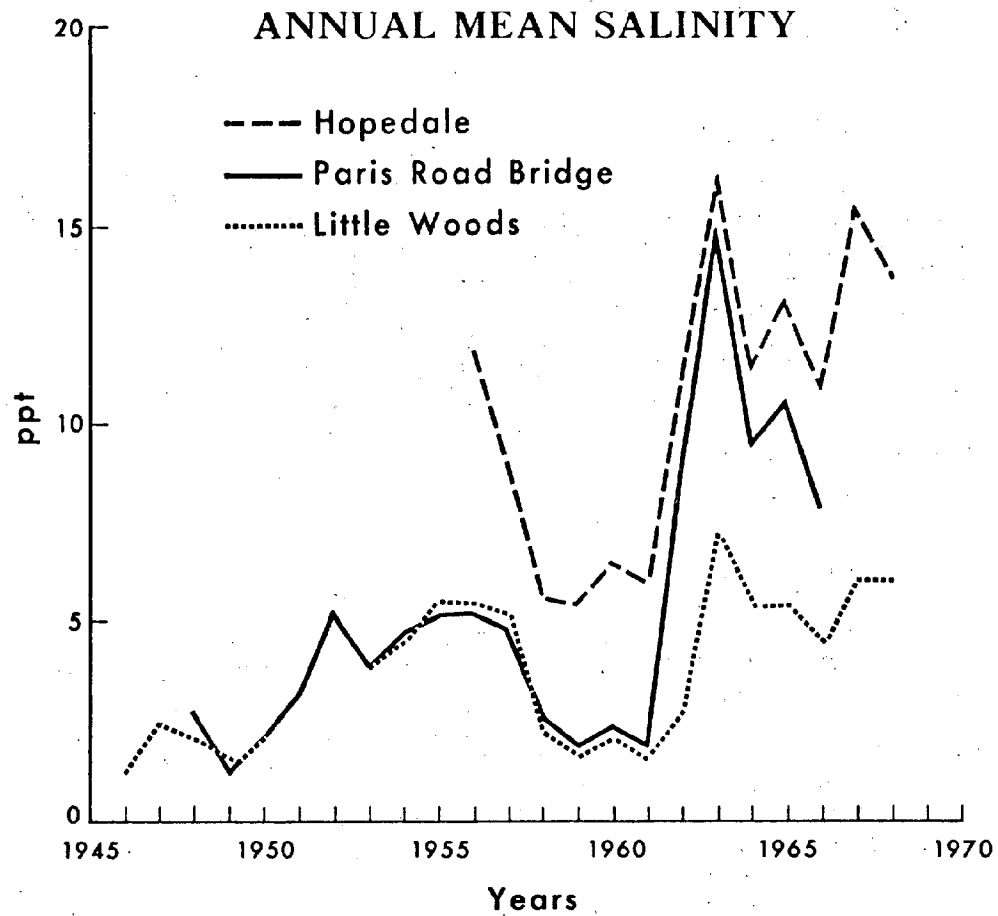


Fig. 3.27

Source: Published and unpublished records of the New Orleans District. U.S. Army Corps of Engineers. Salinities in ppt.

MONTHLY SALINITY RANGE Paris Road Bridge

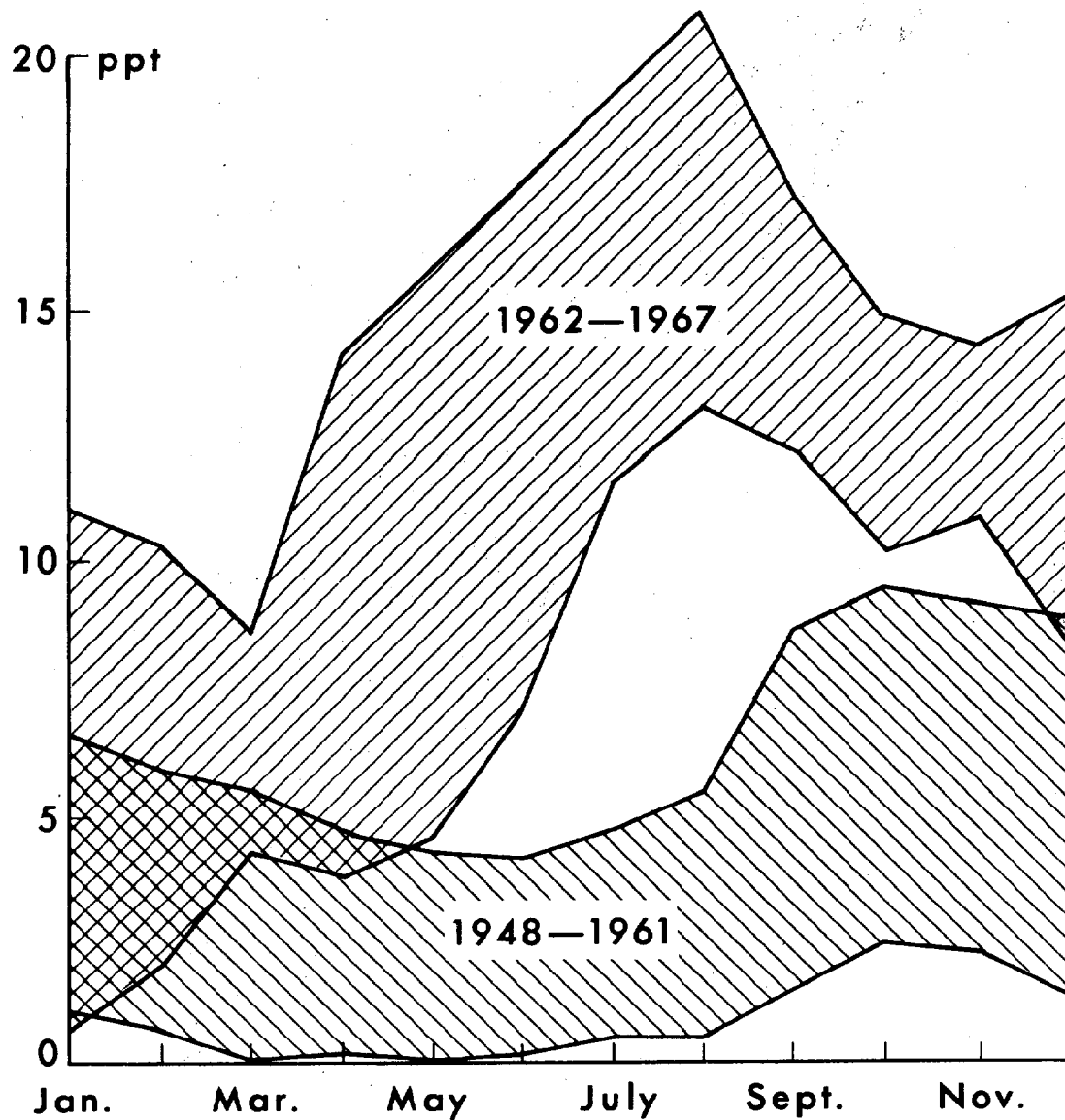


Fig. 3.28 Source: Salinities from Paris Road Bridge Station, Lake Pontchartrain. Data from published and unpublished records of the New Orleans District, U.S. Army Corps of Engineers.

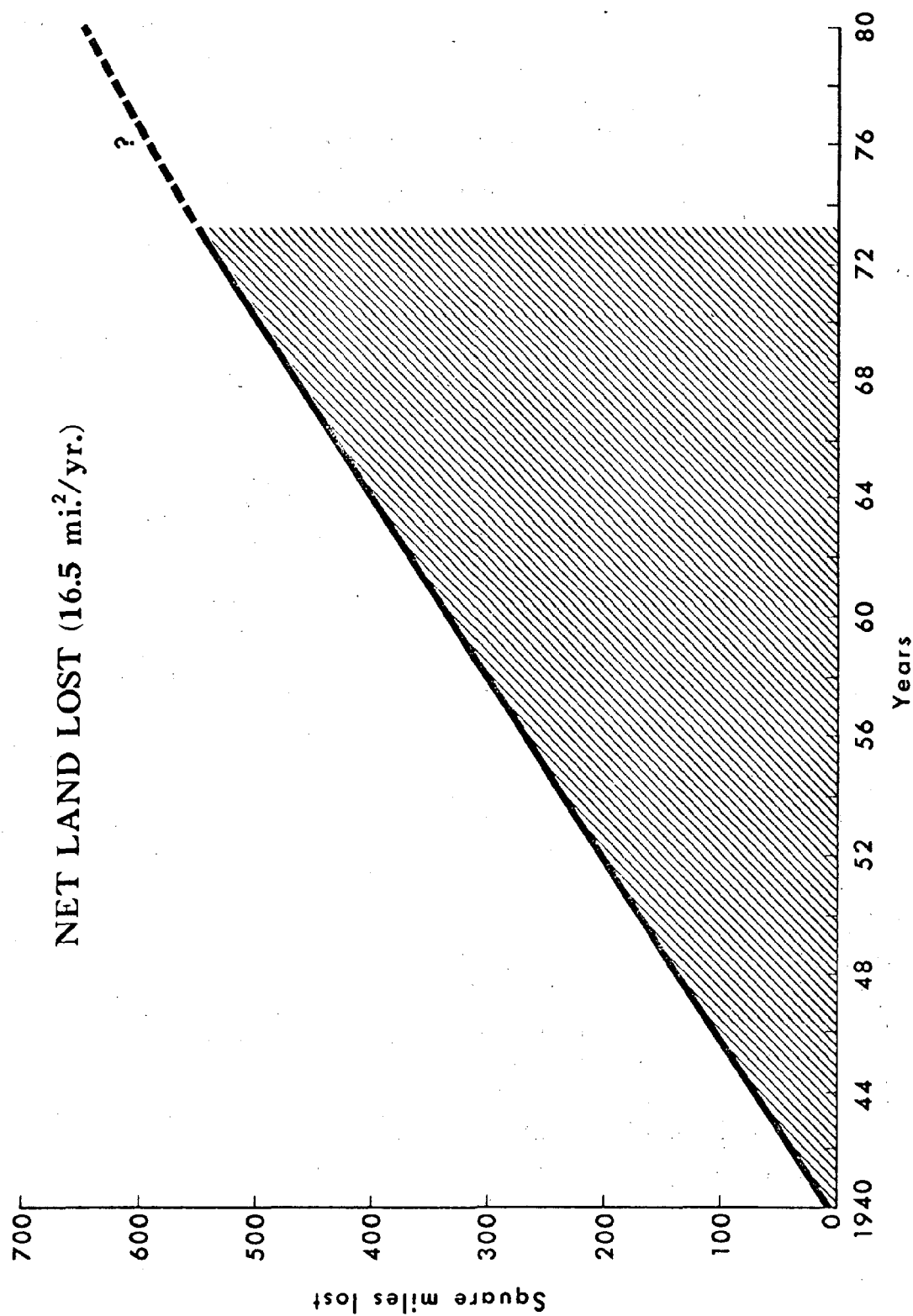
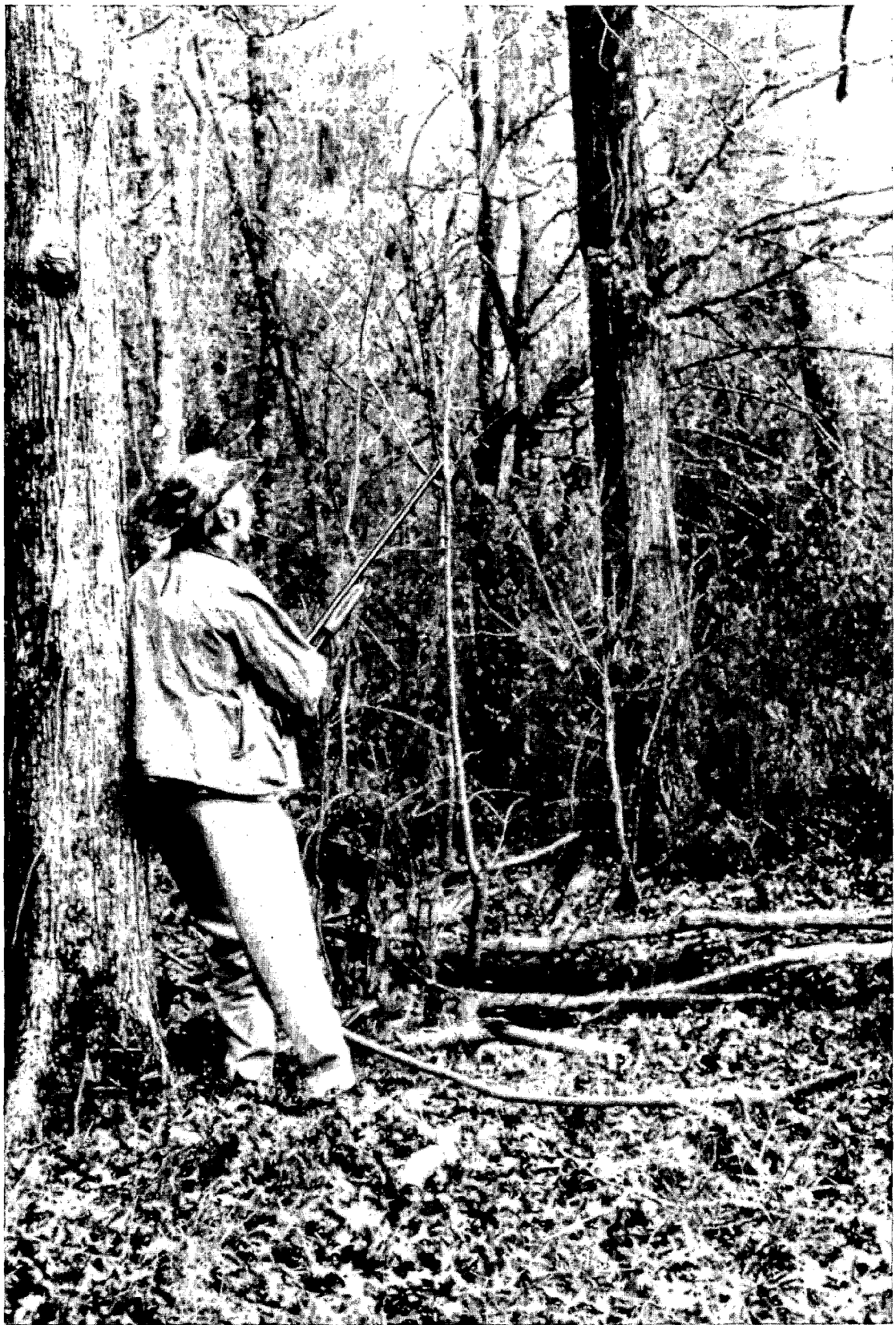
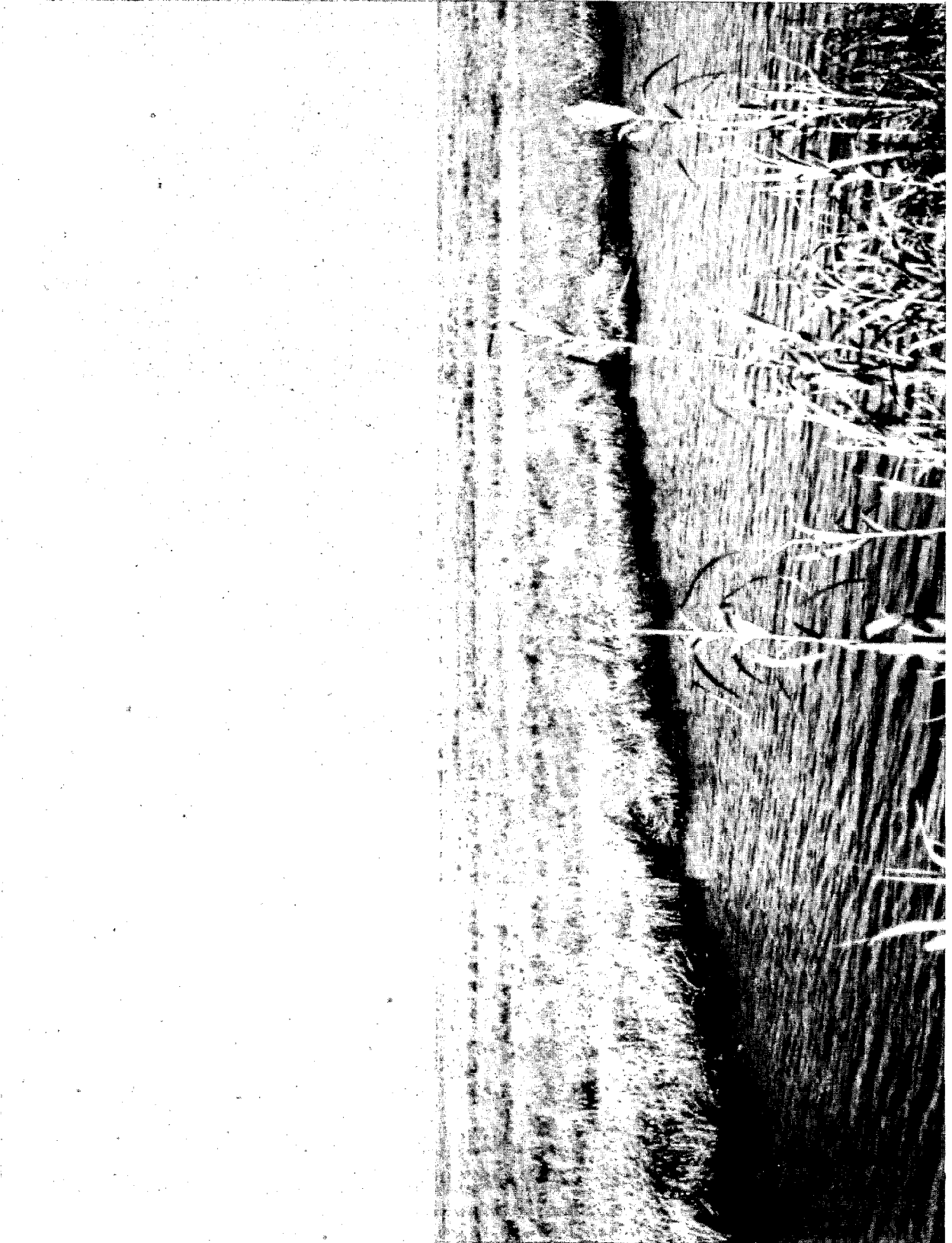


Fig. 3.29 Source: Coastal Studies Institute and Center for Wetland Resources, LSU-BR, "Hydrologic and Geologic Studies of Coastal Louisiana" Report #1.

In addition to stresses on the ecosystem, conflicts are developing over competing uses of resources and can be expected to intensify in the future. Use of water is but one example. Municipalities and industries use water for waste disposal, while oystermen and other fishermen use it to grow seafood. Conflicts occur when polluted waters prevent the growth or harvesting of seafood.

In summation, this study of trends indicates a clear need for rational coastal zone resource management, if we are to continue to reap benefits from coastal zone resources.





CHAPTER FOUR

PLANNING AND MANAGING GROWTH AND CONSERVATION IN THE WETLANDS

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A. Growth and Conservation in Wetland Areas

Wetlands are lands in close proximity to bodies of water characterized by near-surface water tables and/or inundated at least part of the year. Swamps, marshes, flood plains and river basins are examples. Soils, excluding sand bodies, associated with wetlands are generally waterlogged, mucky, unconsolidated and contain highly organic matter such as undecomposed plants. In general, wetlands yield wildlife and vegetation rivaling the most intensive land-based agriculture in terms of organic matter produced. This combination of wetness, unstable soils and high productivity leads to special conditions which constrain growth and development in wetland areas. Some of the more important constraints are discussed below.

1. Building in Wetlands

Urban and industrial development in wetland areas must be preceded by: (1) flood protection from river overbank flooding and excessive storm tides, and (2) draining and filling of the area to reduce susceptibility to floods, improve foundation conditions and reduce subsidence (sinking). These problems, inherent in wetlands areas, are present in addition to the normal site preparation problems of erecting structures. These special building problems in wetlands are addressed in detail later.

a. River Flood Protection

America's greatest river, the Mississippi, courses down eastern Louisiana on its journey to Louisiana's Gulf Coast where its bird-foot delta is located. Having the fourth largest drainage basin in the world, the river drains 41 per cent of the 48 conterminous states of the United States. The basin covers more than 1.25 million square miles, includes all or parts of 31 states and two Canadian provinces and roughly resembles a funnel with its spout at the Gulf of Mexico. The lower valley, underlain by Mississippi River sediments, is a relatively flat plain that would be flooded during times of high water if it were not for man-made levees.

In the past, the Mississippi River overflowed annually onto its flood plains.

Prior to 1879, flood control consisted of levees erected by local interests, with individual landowners bearing all costs. However, these levees were inadequate and massive floods occurred in 1847, 1850, 1858 and 1859 badly damaging them. During the War Between the States, flood control work came to a standstill and the remaining levees were destroyed by floods or the contending armies.

By 1879, the necessity for coordination of any engineering operation through a centralized organization was apparent. That year, Congress established the Mississippi River Commission which, among other things, was charged with the prevention of destructive floods. Levee construction was begun by the commission in 1882, but flood control benefits were only incidental. The primary thrust of the work was to improve the river for navigation purposes. Floods in 1912, 1913, 1916 and 1927 pointed to the need for more extensive flood control structures. The flood of 1927 was the most disastrous in the history of the lower Mississippi valley. Cities, towns and farms were flooded; crops were destroyed and industry was paralyzed. Property damage amounted to about \$1 billion measured in today's values. In addition, 214 lives were lost and 637,000 people were displaced.

This disaster awakened the national conscience to the dire need for flood control in the lower valley. Out of it grew the Flood Control Act of 1928 which committed the federal government to a definite program of flood control. Present projects date from that act.

Subsequently, the U.S. Army Corps of Engineers, charged with flood control responsibility, has evolved a plan which allows the lower Mississippi in combination with the Atchafalaya River to carry a maximum combined capacity of 3 million cubic feet of water per second. The principal structural components of this plan are: (1) the Atchafalaya Basin Floodway via the Old River control structure 80 miles above Baton Rouge, (2) the Atchafalaya Basin via the Morganza Floodway, 50 miles upriver from Baton Rouge, and (3) the Bonnet Carre Spillway. The Old River Control Structure and the Morganza Control Structure can each remove approximately one fourth of the flood flow so that about one half the overflow is confined to the Atchafalaya Basin. The remaining flow would pass Baton Rouge safely and another quarter of a million cubic feet per second would be taken from the river above New Orleans through the Bonnet Carre Spillway to Lake Pontchartrain.(1)

Of the three flood control structures, the Bonnet Carre Spillway and the Morganza Spillway have been used. The floods of 1937, 1945, 1950 and 1973 required the use of the Bonnet Carre Spillway to lower river levels at New Orleans. The Morganza Spillway was opened in 1973 only.

In addition to the levees which confine the rivers to channel, levees often are required to keep tidal and storm waters away from development in low-lying wetlands. Such levees generally are smaller than river levees and usually ring developments with a protective barrier.

The people of South Louisiana have benefited greatly from flood control structures devised to hold back river, storm or tidal floods. However, some attendant costs, other than monetary, must be examined objectively.

Although realizing the legitimate need to protect populated areas from inundation, one should recognize that additional levees in unpopulated wetlands represent an irreversible commitment of a natural resource, thereby precluding other specific uses, such as fish and wildlife production.

The leveeing of the Mississippi to its mouth to prevent flood damage to inhabitants of the flood plain has caused loss of freshwater nutrients to the estuaries and loss of sediment to build new land. Attendant problems include erosion and salt-water intrusion.(2)

In the past, the annual overbank flooding of the river caused a recharge of the ecosystem (all living and non-living things considered as a unit). The flooding generated a new ecosystem and allowed subdominant species, which are faster growing and denser, to dominate for a time. After levees were built, annual overbank flooding ceased.

With the cessation of the annual flooding cycle in the life of the estuary, some changes in biological productivity of the estuaries can be expected. It is unclear what direction these changes will take; however, some insight into the situation can be achieved by examining some current problems with fisheries production.

Evidence indicates saltwater intrusion is affecting the oyster and shrimp crops. Oyster production has remained relatively static over the years but fishing effort and the acres of oyster grounds being cultivated have increased manifold.

Thus, the production of oyster meats per acre has decreased drastically over the years. Freshwater, which in the past protected young oysters from the conch (an oyster predator which prefers saltier waters), is now retained within the levee system and supplementary freshwater is being introduced into the oyster grounds by syphons installed and operated by the fishermen. This indicates that the need for freshwater in the estuaries is a most pressing problem.

Any system that affects water flow will have effects downstream and changes in these flows can have dramatic effects on the ecosystem. Upstream watershed projects, water diversion and flood control projects have removed the flood cycles from the river and changed the seasonal flow. Seasonal high and low water stages have been smoothed out. The Mississippi River usually does not have spring flood peaks as it did previously nor does it carry the year-round flow as before. The flood conditions of 1973 are unusual and do not indicate the true nature of the river's flow.

In addition to affecting living resources, levees on the Mississippi River have restricted suspended river sediments to the river bed and prevented sediment from building new deltaic land masses. The 260 million tons per year of sediment carried by the river are now deposited at its mouth in the oceanic deep off the continental shelf. The net result is an annual loss of 16.5 square miles of marshland as the continual erosion and subsidence is no longer offset by sedimentation and accretion.(3)

Atchafalaya Basin and Bay are the exception to the erosion rule. Silt deposits are causing the basin to fill in and evolve from a freshwater swamp to a hardwood bottomland. However, when viewed as a whole, the Louisiana coastal zone is eroding rapidly, with net losses of 500 square miles over the past 30 years.

The levees are probably a permanent feature of the coastal zone landscape but some of the land loss may be offset by the delta building management proposals being set forth.(4) Perhaps the effects of erosion can be alleviated somewhat by man-made barrier islands. These would also enhance the recreational potential of the coastal zone.

b. Storm Surge Protection

Flood protection from storm tides is the second major type of protection needed if growth and development are to proceed in wetlands. The wetlands do much to absorb storm-driven waters; however, when wetlands are used for residential

or commercial development, their flood-absorbing characteristics become a liability.

"Flood control policy should encourage rational decisions about the location of private investment in flood lands, through flood plain zoning, insurance techniques and other devices, so that the federal government is not called upon to protect from damage investments that should not have been made in the first place."(5)

"The most ridiculous aspect of much of the building occurring in wetland zones is that millions of dollars have to be invested in building flood protection levees before any building can begin."(6)

The environmentally harmful effects of levees on wetlands include disruption of hydrology (waterflow), salinity (salt content), and nutrient cycles with subsequent loss of vegetation, habitat and productivity.

c. Wetlands Drainage and Filling

Louisiana coastal marshes are subsiding at measurable rates of 4.0 ft./100 years.(7) Other places have reported comparable rates of subsidence.(8) This may be a natural phenomenon but it should, at least, be noted by planners. Preventive action may be impossible but some remedial action could be considered.

Once leveed and drained, a wetland environment undergoes additional irreversible subsidence resulting from drying, compaction and oxidation, which may lower the elevation as much as a foot per year during the first few years. Initial subsidence is estimated to be about one third of the difference between the soil surface elevation before drainage and the water table after drainage.(9) After initial subsidence, a slower but continual subsidence is evidenced as organic matter in the soil decomposes. This subsidence creates many foundation problems related to building and maintenance of housing, streets, sewers and other services.

Adequate foundations for housing and streets in wetlands require pilings to prevent them from sinking with unsupported structures such as sidewalks, driveways, and sewer and drainage lines. It is not unusual to find housing built on former wetlands with the piling-supported concrete slab separated from

the ground.* The costs of maintaining public services such as sewers, drainage, streets, sidewalks, etc., are higher than corresponding costs on stable soils and must be borne by the taxpayer. The homeowner must bear the cost of subsidence on his own property.

Subsidence creates many problems associated with the use for which the area was drained initially. For instance, draining wetlands for agricultural production will result in subsidence, which in turn increases the chances of inundation and pumping costs. Consequently, the land is rendered unsuitable for agricultural uses within a few years.

In the past, land fill in Louisiana wetlands generally has been limited to undeveloped spoil disposal areas near dredged navigation channels.(10) However, with increased urbanization and industrialization spurred by population growth,(11) this can be expected to change. Approximately five per cent of the estuarine habitat of the U.S. Gulf Coast has been removed by dredging and filling operations.(12) In Louisiana 3.1 per cent, or 65,400 acres of important estuary habitat have been lost by dredging and filling,(13) primarily for navigation channels.

Filling wetlands commits this natural resource to a use which precludes some other utilization and may not be in the best interests of the people of Louisiana.

Commission Recommendations Concerning Building in Wetlands

The Commission recommends that heavy industrial development should not occur in substantially undeveloped wetlands when alternatives exist. Feasible corridors for transportation, industrialization or urbanization should be designated in already disturbed stable areas. These corridors should not be construed to extend into sensitive areas such as extreme low-lying lands at the mouth of the river.

*A number of companies in New Orleans specialize in grouting (filling in with mortar) such structural deficiencies.

The Commission recommends that residential and industrial developments in low-lying areas be discouraged by flood plain zoning, insurance techniques and other devices. This would not pertain to minimal amounts of construction such as camps, recreational facilities, etc., which would not interfere with the natural system.

The Commission further notes that flood control policies in particular, greatly encourage urban sprawl and continued population growth at the expense of wetlands and agricultural land. Flood control is treated as a non-reimbursable cost at the federal, state and local levels. In other words, all people share the cost of flood control, regardless of whether they live on lands where an undue flood hazard exists. Many of today's problems of urban sprawl would be halted abruptly by a reversal of this public policy.

The Commission recommends that present federal, state and local policies discourage flood control in undeveloped wetlands, and that public subsidies for the urbanization of wetlands be revised so the protected land will incur a more equitable portion of the cost of such facilities. In addition, the Commission recommends that at the state level there be: (1) subdivision requirements based on the environmental constraints of the area to be developed and (2) permit requirements for urbanization and industrialization in coastal areas. At the regional or local level there should be: (1) zoning of flood plain lands to regulate development; (2) subdivision regulations and (3) building and housing codes. All of these should be designed to protect the individual home owner or businessman from the adverse effects of locating in a flood plain but such protection need not involve public expense.

The Commission recommends that water diversion structures along the Mississippi River be built to restore some of the freshwater/salt-water balance disrupted by man-made levees. These water diversion structures should be designed and constructed to aid living resource production.

The Commission recommends that in plans for flood protection the U.S. Army Corps of Engineers, the Louisiana Department of Public Works and other appropriate agencies consider the values of undisturbed wetlands along with the values of flood protection.

The Commission recommends that the U.S. Army Corps of Engineers, the Louisiana Department of Public Works and other appropriate agencies take immediate actions to protect the wetlands from erosion caused by wave action, hurricanes and other natural causes. These actions could take the form of preservation or construction of barrier islands at or off the coast in areas where erosion is most severe. However, these flood protection works should take into account the need for the water exchange necessary for the life of the wetland areas. Future flood protection designs for the Mississippi River should incorporate water diversion facilities for marsh or land rejuvenation.

2. Groundwater

Groundwater refers to aquifer water (which is in strata beneath the land surface) and supplies much of our urban and industrial needs.

Louisiana's groundwater problems center about excessive drawdown (overpumping) of aquifers, which leads to lowering of the aquifer water table and the resultant (1) saltwater intrusion into the aquifers and (2) subsidence of the land surface above the aquifer. Subsidence caused by excessive drawdown is difficult to ascertain in wetland areas because the area is already in a condition of general subsidence.

a. Saltwater Intrusion into Aquifers

Accelerating withdrawal of ground water for agricultural uses is causing intrusion of saltwater from saline aquifers in some areas. This is especially true in Vermilion Parish where high rates of withdrawal are needed for rice farming. The Louisiana Department of Public Works has found that "large

industrial and agricultural requirements in areas of south Louisiana will present serious ground water problems in the future."(14)

The abundant rainfall of south Louisiana provides enough water for most farming operations; however, rice farmers, because of the nature of their crop, use additional water. They obtain this water from canal companies at a price or from their own wells. About one third of rice irrigation is done from private wells.(15)

"In the recent past, the water gradient (slope) in southwestern Louisiana has been toward the Gulf. However, heavy withdrawals for irrigation and industry have reversed the gradient along the coast and caused saline aquifers to move slowly northward."(16) Governmental controls over the use of water are not apparent. A publication of the LSU Department of Agriculture Economics notes that "to prevent salt intrusion into the irrigation wells of the coastal region, some water management practices appear desirable, particularly to relate the amount of pumping to the availability of freshwater recharge (replenishment) mainly from rainfall and non-salty river flows."(17)

b. Subsidence and Industrial Withdrawals

Subsidence of the land surface, and other ground water problems because of excessive drawdown have been noted in a number of cases. Baton Rouge is subsiding, especially in the industrial complex in North Baton Rouge because of a high water-withdrawal rate.(18)

The Louisiana Department of Public Works has found that "Large industrial and agricultural requirements in areas of south Louisiana will present serious ground water problems in the future. Heavy industrial withdrawals in Lake Charles, Baton Rouge, and New Orleans are presently causing large declines of water levels and saltwater encroachment in some of the local aquifers."(19)

Commission Recommendations Concerning Groundwater

The Commission recommends that ground water drawdown be regulated for conservation purposes and include aquifer recharge, if feasible. The Louisiana Department of Public Works has begun a program of inventory for ground water use in the state. In addition, the Department of Public Works should develop a program for ground water

conservation and present it to the legislature within one year. Local government should participate in but not dominate the program. One aspect of ground water conservation could be greater use of surface water for industrial purposes. Industries located at available surface water sources, e.g. rivers, lakes, etc., should be encouraged to use this water rather than aquifer ground water.

3. Surface Water

Surface waters can be managed for various uses. Louisiana is probably the nation's only state endowed with excess surface waters. During floods, this can be a curse but most of the time it is a blessing. Various types of techniques and structures are used to manage the excess surface water. Benefits are derived from management of the water but attendant costs rarely are recognized. Some of the costs and benefits of water control projects are discussed below.

a. Water Control Projects

When canals for pipelines, oil well access or navigation are dredged across watercourses in wetlands areas, the new canal often serves as a conduit or passageway for saltwater intrusion into previously brackish or fresh marshes. This can result in significant changes in vegetation, wildlife and marsh as the brackish or fresh system becomes more saline. Some of this unwanted and unnecessary change can be reduced by the use of dams or weirs across the man-made waterways where they intersect natural waterways. This prevents the waters from mixing.

Dams are also used in upland areas to create reservoirs of water which can then be released as the need arises. They produce benefits of controlled water use and recreation, but cause side effects of hydrologic interruptions and silt deposition behind the dam.

Canals sometimes are dug to hasten the drainage of water from a river watershed area to its receiving basin. The canal reduces upstream river stages during periods of high flow, but also reduces river levels in times of low flow. This reduction can have adverse effects as the general water table of the area

subsequently drops. Additionally, less flooding occurs in the downstream portion of the river's flood plain and this causes changes in the hydrologic system. Examples of the effect water control structures can have on living resources are:

(1) Concurrent with the construction of the dam on the Sabine River to create the Toledo Bend Reservoir, there occurred a drastic reduction in the shrimp production downstream in Sabine Lake as salinities increased.

(2) The construction of the Amite River Diversion Canal caused faster runoff (emptying of the drainage basin) and reduced flooding in the Maurepas and Blind River Swamp. A reduction in muskrat and crawfish production resulted as the ecosystem and vegetation changed.

The above-mentioned projects produce benefit to the state and society but not without cost. Often these costs can be reduced substantially if proper controls are introduced in the planning and construction phases of the project. The controls should suit the particular project and be designed to preserve environmental qualities that need not be lost as a result of the project. This can be done only if all costs--environmental, economic and social--are considered in the planning stages of a project.

Another type of water control structure consists of those to create impoundments (reservoirs) of freshwater for agricultural use in wetlands. The Schooner Bayou and Catfish Point Control Structures regulate the water levels in Grand and White Lakes primarily for irrigation.(20) Although the structures do provide water for irrigating crops and the need for the water is recognized, it should be realized also that halting or reducing freshwater flows into the estuaries can have detrimental effects in some instances.

The Commission understands the need for positive water resource programs which can offset some of the man-made changes in the coastal zone. Some examples are freshwater introduction into the estuaries to offset saltwater intrusion and introduction of sediment-laden water into areas which are conducive to delta building. (See Chapter Six, Section Four)

Commission Recommendations Concerning Water Control Projects

The Commission recommends that control structures (weirs or dams) be required wherever new waterways cross a watercourse or land-water interface to maintain the integrity of the hydrologic regime. In addition, there should be a system whereby ongoing surveillance by the Office of Coastal Zone Management and maintenance by the landowner or lessee of this structure is routine.

The Commission recommends that water-level control structures, such as those in Grand Lake and White Lake for impounding freshwater, be investigated thoroughly to determine whether water use patterns are being affected or salt-water intrusion is occurring because of the structures.

The Commission recommends that the U.S. Army Corps of Engineers, the Louisiana Department of Public Works and other appropriate agencies initiate projects to divert freshwater river flows to aid in replacing land lost through erosion and subsidence, to add nutrients to estuaries and to retard saltwater intrusion. In addition, the Louisiana congressional delegation should request that the U.S. Army Corps of Engineers initiate a feasibility study of major land building in areas of serious erosion in Louisiana through controlled diversion of sediment laden waters.

b. Watershed Projects

A major type of water resource project is the watershed project, which is intended to reduce flooding and increase the rate of drainage on lands in the project area. Currently, many watershed projects are planned for Louisiana--some of them in the coastal zone. The projects usually involve grading of watersheds and stream slopes, removal of vegetation to reduce flow obstruction, and realignment of streams.

A 1964 study by two members of the North Carolina Wildlife Resources Commission compared fish populations in 23 channelized streams with populations in 36 nearly natural streams. Their findings indicate that channelized streams

had 90 per cent fewer catchable game-size fish.(21) An unpublished study by the Mississippi Game and Fish Commission in 1968 showed a decrease in pounds of fish per acre in the Tappah River from 250.7 before to 4.8 after channelization.(22) The Louisiana Wild Life and Fisheries Commission has performed similar research with comparable results.(23)

Commission Recommendation Concerning Watershed Projects

The Commission recommends that the Louisiana Department of Agriculture, the Soil Conservation Service and other appropriate agencies initially evaluating the effects of watershed projects identify environmental values and give them the same consideration afforded engineering and economic values.

4. Water Quality

Population pressures on the Louisiana coast to expand services (industry) and housing (urbanization) into the wetlands can be expected to rise as the population increases at a rate 33 per cent higher than the national average. This constitutes an increase in the number of people per square mile from 144 in 1970 to almost 200 per square mile in the year 2000.(24) Such population increases intensify the problems of water pollution.

The effects of pollution can be more severe in the coastal zone than elsewhere because of the nutrient trap characteristics of an estuary. Some processes in estuaries effectively trap nutrients essential for the high biological productivity observed in such areas. "Unfortunately, all of the factors which enable an estuary to concentrate and recycle nutrients also allow the estuary to become a pollution sink."(25)

a. Overview

In large measure, the water quality of Louisiana wetlands is related to the quality of the freshwater in the many rivers in the coastal zone. For this reason, high quality water in the river basins is important.

Unfortunately, some of our rivers do not have water of high quality. The Environmental Protection Agency threatened New Orleans with loss of federal funds if the city did not

provide adequate treatment of sewage.* Domestic sewage discharged into the Mississippi River contributes to high bacterial concentrations downstream.(26) The high coliform count could prevent diversion of Mississippi River water to the estuaries. Forty-six organic chemicals have been found in the New Orleans drinking water.(27) Fish caught in the Mississippi River immediately below Baton Rouge are not salable because of off-flavor.(28) Turbidity (murkiness) caused by suspended particles such as silt is increasing in many of our streams as land clearing for agriculture, industry or urbanization increases. Land denuded of trees and other vegetation quickly loses topsoil to rain runoff and eventually is absorbed in a waterbody. Consequently, turbidity and siltation increase and combine to lower productivity because sunlight cannot penetrate the turbid water. Additional effects are the covering of fish and other aquatic eggs with sediment and eventual silting-in of the waterbody.

The most extensive land clearing activities in Louisiana have been for agricultural purposes, primarily for soybean production. In one parish alone, Concordia, ". . . land clearing took place at a rate of about 8,500 acres per year. . ."(29) for a total of about 85,000 acres cleared over the past decade.

A publication of the Louisiana Department of Public Works notes that "the dissolved solids discharged to the river by industry between St. Francisville and Luling Ferry (16 miles above New Orleans) have increased from about 4,000 tons per day in 1958 to about 20,000 tons per day in 1969. Municipal effluents add less than 1 per cent of the waste load discharged by industry."(30) Heavy metals dumped into the river attach to the suspended sediments and prevent the diversion of those sediments into the estuaries for salinity control, nutrient enrichment or controlled sedimentation.

The other rivers emptying into the Louisiana coastal zone have fared poorly too. Food processing and other wastes have created problems in the Vermilion River. Lake Calcasieu and the Calcasieu River are rather heavily laden with industrial wastes. A commercial fishery involved in interstate shipment of fish from Lake Calcasieu closed when informed by the Food and Drug Administration of mercury contamination of seafoods from those waters. (31) The source of the mercury is believed to be a chlor-alkali plant in the area which uses mercury cells in the manufacturing process.

*"The Morning Advocate," Baton Rouge, La. 6/23/72 p. 10b col. 4.

The Army Corps of Engineers notes: "A credible theory set forth by some authorities suggests that even low concentrations of toxic materials encountered in some industrial effluents far upstream may well be carried into estuarine areas and concentrated there as a result of natural scouring, suspension, settlement, dredging, resuspension, and resettlement."(32)

b. Urban Pollution

Urban pollution in the coastal zone involves disposal of wastes (solid wastes and sewage) in wetland areas. The natural systems can assimilate some degradable wastes. However, if the system is overloaded, all dissolved oxygen in the system is consumed and all aerobic (oxygen using) organisms are destroyed.(33) One example of the detrimental effects of a high bacteria count is that oyster harvesting in Lake Borgne was closed temporarily by the State Board of Health several times because of sewage pollution from the New Orleans area.

c. Ocean Dumping

Ocean dumping can also affect water quality. It is estimated that over 1/2 million tons of waste were discarded by dumping in the Gulf of Mexico in 1968--a 65-fold increase over 1952.(34) Dredging spoils were estimated to constitute 95% (by weight) of the materials dumped, and about 31% of these spoils were considered to be polluted. The remainder of the dumped wastes were refinery, petrochemical and paper mill effluents. "Refinery wastes include highly toxic pollutants such as cyanides, mercaptides, chlorinated hydrocarbons, and heavy metals. Petrochemicals and related laboratory wastes frequently include arsenical and mercuric compounds. Paper mill wastes may contain "black liquor" and toxic organic substances. Black liquors in concentrations as low as 0.5 grams per liter seriously reduces photosynthesis needed for survival of phytoplankton, a basic organism in the marine food chain."(35)

d. Oil Spills

The effects of oil spills still are being disputed among researchers. Some research has indicated little or no long-term effect, while other studies do indicate long-term effects.

Regardless of the outcome of the debate over the effects of oil on marine organisms, no one is in favor of spills. Hence,

prevention seems to be the answer. The use of dispersers and emulsifiers seems to merit some attention, as studies(35) have concluded that "the oil spill removers were much more toxic than the crude oils."

Commission Recommendations Concerning Water Quality

The Commission recommends maximum surveillance and enforcement of all water quality standards of the state Stream Control Commission, Department of Health and federal Environmental Protection Agency (EPA). This will insure that water quality levels vital to estuaries will be sustained. To achieve maximum surveillance and enforcement, the state's Stream Control Commission must be strengthened. EPA, when reviewing the state's water quality program, recommended that the staff, equipment requirements and budget of the Stream Control Commission be tripled. It advised of the need for qualified laboratories and personnel, and the difficulties in holding qualified personnel because of poor pay scales under the state's civil service system.

The Stream Control Commission should begin public information services to heighten public awareness of pollution control efforts. Immediate attention should be given to the quality of water in the Mississippi River, Lake Borgne, Lake Pontchartrain, Calcasieu River basin and the Vermilion basin.

5. The Fishing Industry

The fishing industry in Louisiana is one of the largest users of renewable resources in the state. In recent years, the annual catch has exceeded one billion pounds, with a dock-side value of about \$70 million. Fish and shrimp stocks renew themselves each year with little assistance from man; however, oysters require more human effort because they must be transplanted for the best yields.

In addition to the widespread problems of habitat loss resulting from the leveeing, pollution, draining and filling, and channelization discussed previously, specific concerns are discussed below.

a. Fish, Shrimp, Oysters, and Petroleum

Petroleum drilling platforms in waters off the Louisiana coastline serve as artificial reefs by providing edge, or interface, which can support ecological communities, including fish. The platforms have fostered the development of commercial and recreational fishing by concentrating fish so they are accessible to the fishermen. In some inshore bays and waters, the density of oil structures prevents navigation by large fishing boats. As a result, the area serves as a marine sanctuary. However, there are areas of conflict.

In the past, conflicts have occurred between shrimpers and other commercial fishermen over actions of the oil and gas industry. Complaints by fishermen usually concern submerged objects such as well stems, pipelines and debris, all of which can catch and damage nets. Recent regulation changes should result eventually in the removal of all stems protruding above the ocean floor. At present, there are approximately 200 of them.(37) In addition, the Army Corps of Engineers notes:

"Offshore structures and appurtenant pipelines have created considerable difficulties for commercial fishermen by creating both hazardous navigation problems and seabed obstructions. Significant fishing areas are lost due to high concentrations of structures and appurtenances..... Many areas of trawling and purse seining grounds can be effectively removed from traditional fishing grounds by reason of safe operating clearances from structures."(38)

Disputes between oystermen and the petroleum industry generally occur when oyster production is interrupted by petroleum industry activity.

Seismographic techniques for oil exploration involve the creation of shock waves which penetrate the earth's surface and are reflected or refracted by subsurface strata. By reading the reflected or refracted waves which return to the surface, experts can determine the location of geologic structures suitable for oil accumulation. In the past, the shock waves were created by explosives detonated close to the land surface and underwater in the offshore areas. The underwater explosions were said to be responsible for the loss of oysters because of shock and disturbance of bottom sediments.

At present, the careful laying of seismographic shot lines to avoid oysterbeds and the use of wave generators with no explosives appear to have resolved the problem satisfactorily.

Dredging for pipeline canals and oil well access canals has on occasion resulted in disputes over oyster losses caused by siltation. Since silt can travel some distance from its dredging source, oyster beds away from the dredging can be affected. Careful regulation of canal routes and additional surveillance of silt "plumes" would go far toward alleviating the conflict.

Oil spills and low-level persistent pollution present taste problems to oyster growers because oysters can acquire an oily taste. Prevention of spills and low-level chronic pollution by industry control techniques, with close monitoring and surveillance by appropriate state agencies should eliminate the conflict.

b. The Fishing Industry and Habitat

Water quality problems affecting habitat and having the most significant economic impact on the fishing industry include high coliform levels in Lake Borgne and the Mississippi River. High coliform levels are the result of urban effluents. Elevated bacterial counts in these areas have resulted in the closure of oyster beds to harvesting on a number of occasions.

The other serious conflict between renewable and non-renewable resources involves competition for available production space on the waterbottom. This is especially true for the oyster industry, where pipeline canals, oil well access canals and well locations have removed oyster producing areas.

6. Pesticides--the Chlorinated Hydrocarbons

Pesticides are used in agricultural efforts to stabilize the agricultural ecosystem, that is, eliminate unwanted pests. Unfortunately pesticides are known to migrate via air and water long distances from where they are applied, thus creating the potential for environmental harm. The chlorinated hydrocarbons have come under close scrutiny, e.g., recently DDT was banned by EPA for most uses.

Chlorinated hydrocarbons are a class of pesticides known as "hard" or persistent, which means they remain active in the environment for a long time and are only slowly weakened by weathering or chemical action. Some members of this family are DDT, Dieldrin, Aldrin, Endrin, Mirex, Chlorodane, Toxaphene, Heptachlor, BHC and Lindane.

DDT and other chlorinated hydrocarbons have been shown by a large number of studies to cause mortality and reproductive failure in fish, birds and other species.(39) Mechanisms for the mortality involve two critical factors: (1) the concentration effect and (2) the persistence of the pesticide. Many species of organisms will concentrate and store the chlorinated hydrocarbons in fatty tissues to levels tens of thousands of times greater than in the surrounding environment.(40) Pesticides other than chlorinated hydrocarbons do not accumulate in animals.(41) The second important effect in the mechanism is the long-lived nature of the pesticide, which allows it sufficient time to accumulate in sediments and biota.

In Louisiana, the Mississippi River fish kills of the early '60s led to an investigation by the U.S. Public Health Service, which traced the deaths of five million fish to lethal amounts of Endrin in the fish. The source of the pesticide was traced eventually to a chemical company in Memphis, Tenn. The Louisiana State bird, the brown pelican, disappeared soon thereafter "and it is possible that the Endrin in the fish eaten by this species was the cause of its disappearance on the Gulf Coast."(42) Pelicans stocked by the Louisiana Wild Life and Fisheries Commission on Rockefeller Refuge in the western part of the state soon died. Tissue analysis indicated high concentrations of DDT, Dieldrin and Endrin--all chlorinated hydrocarbons.(43) Upstream agricultural spraying associated with rice farming utilizes chlorinated hydrocarbons.

Oysters,(44) shrimp,(45) crabs,(46) and fish(47) are all adversely affected by chlorinated hydrocarbon pesticides. The danger to man and his environment long has been recognized by scientists and others. The Housing, Education and Welfare Dept.'s Commission on Pesticides and Their Relationship to Environmental Health recommends: "Restrict the usage of certain persistent pesticides in the U.S. to specific essential uses which create no known hazard to human health or to the quality the environment. . . ."(48)

At present, the Louisiana Department of Agriculture, in conjunction with the U.S. Department of Agriculture, is contemplating spraying Mirex, a chlorinated hydrocarbon, on millions of acres of land to control the fire ant. In view of the widespread

usage of the pesticide and its known toxicity for shrimp, crabs, and other crustaceans, the spraying program should be reconsidered.

Commission Recommendation Concerning Pesticides

The Commission recommends that all chlorinated hydrocarbon pesticides be phased out and replaced by other pesticides such as the non-persistent carbamates or organophosphates.

7. Transportation

a. Water Transportation and Pipelines

Water transportation incorporates the extensive network of navigation canals which form the backbone of the shipping and towing trade and the access canals used in oil and gas operations. In addition, pipelines will be considered in this section since pipeline canals provide transportation access also. Because the coastal zone is where the land meets the sea, the majority of water transportation facilities, such as waterways and ports, are in the coastal zone. Economic benefits of the water transportation industry are considerable but there are costs other than monetary which should be considered also.

According to the National Estuarine Pollution Study, all activities have impacts on the coastal zone ecosystem, "but the activities having the most impact on water quality are dredging and filling. . . . The greatest percentage of deliberate modification of the estuarine zone is for the protection and maintenance of navigation." (49) Annual harbor and channel dredging and maintenance costs are higher in the Gulf of Mexico than in any other region of the country in terms of cubic yards dredged annually (3.19 million yards) and annual dollar costs (\$4.8 million). (50) Thus, while few doubt the need for navigation channels, it should be recognized that building and maintaining such channels bring about environmental and economic costs being borne by the public.

Oil and gas access canals represent another form of water transportation. These canals are created to transport petroleum exploration and production equipment through wetlands. ". . . In both Louisiana and Texas dredging and filling associated with oil and gas exploration has been the major cause for estuarine physical modifications. (51) The Army Corps of Engineers (52) estimates that 13 per cent of the annual 16.5 square miles net land loss in Louisiana results from dredging

associated with oil and gas operations. The environmental effects of channelization associated with the Leeville and West Bay fields (53) are major changes in surface runoff, tidal exchange and water circulation. These, in turn, alter water chemistry and faunal and floral characteristics.

Pipeline construction also involves dredging. Either a ditch (for pushing pipe) or a canal (for floating pipe-laying barges) is dug to lay the pipeline.

Environmental effects of each of these transportation activities are roughly the same; that is, they involve dredging and the associated spoil banks. Environmental effects of water transportation and pipelines are listed below.(54)

1. Channalization in estuaries can result in direct destruction and loss of nursery areas from dredging, silting, leveeing and erosion. Sessile (non-mobile) animals and bottom organisms are killed or dislocated and marshes may be destroyed, drained and significantly altered.

2. In the past, pipeline canals traversed marshlands and embayments without regard for changes in the natural drainage pattern. Also disregarded were resultant disruption of currents in bays and water flow in marshlands and the direct loss of animals and plants within the right-of-way. The long-range effects of such canals involve accelerated erosion of unstable marshes.

3. Indirect effects of channels (and their spoilbanks) include: (a) changes in water cycling rates and volumes, (b) salt and freshwater intrusion, (c) indirect silting considerable distances from the site of activity, resulting from changes in the direction and velocity of currents and (d) partial or total disruption of normal drainage patterns and water movements.

Commission Recommendations Concerning Water Transportation and Pipelines

The Commission recommends that new pipelines be laid in corridors and located along already disturbed routes. Pipelines must be monitored routinely to insure that they remain at the original depth and to insure quick detection of undesired movement. There should be a state-level program for permitting, inspecting, and reviewing pipeline installation,

construction, and removal of unburied pipelines where feasible. A system of maintenance by the company and removal of oil field equipment should be instituted as part of the permitting procedure.

Multiple use of existing pipelines and rights-of-way should be encouraged. Existing pipelines should be used wherever possible and existing canals should be used for any new pipeline construction. In addition, where it is feasible, pipelines should be pushed through the marsh in small ditches rather than by digging big canals for floating pipeline equipment.

The Commission recommends that new navigation canals be restricted to those uses which are demonstrably of necessity. These canals should be constructed so as to minimize environmental impacts. The Office of Coastal Zone Management must be involved in every phase from inception to completion of the navigation project and should (1) determine whether the navigation project conforms to established rules, regulations, criteria and standards, (2) review and pass upon scientific and technical data of proponents and opponents to the project with a view toward its objectivity and completeness, (3) issue statements of technical material in terms understandable by the general public and (4) provide a regional overview to evaluate regional and cumulative impacts.

The Louisiana Department of Public Works, the Highway Department and private industry serving the offshore oil and gas industry in cooperation with state universities should begin studies to determine the feasibility of using surface effect vehicles (air-cushion vehicles and hovercraft) along with helicopters to transport oil field and other equipment and personnel through wetlands.

The Commission recommends that ports and superports be confined to areas with water depths already sufficient for expected ship drafts. This will minimize dredging and associated environmental changes. Pipelines from any offshore port must be buried, be in corridors and not cause saltwater intrusion. Pipeline construction associated with superports must not result in open canals extending inland from the coast. In addition, the impact on the landscape must be minimized with

adequate provision for esthetics. Any facilities supporting offshore superport activities, or ancillary residential or commercial development resulting from construction of the superport must be in conformity with a state approved coastal zone management program.

The Commission recommends that the Office of Coastal Zone Management promulgate regulations requiring that prominent spoilbanks be avoided, both above and below water, in open waters such as streams, bays, lakes, etc., with penalties for non-compliance.

The Commission recommends that construction agencies initiate pilot projects for testing the feasibility of using dredging spoils to build new land in suitable areas where erosion is occurring. Pilot projects utilizing other innovative methods of handling spoils should also be initiated.

b. Highways and Other Roadways

Availability of land for development is related closely to the problem of accessibility. If land is readily accessible by some means of transportation, it is available for development. Thus, "Transportation, as a service system, is an instrumental factor in the development of land uses." (55) Since highways allow for the greatest movement of people, they are extremely instrumental in dictating land use patterns. It has become increasingly clear that where the highways go, also go people and industry. A publication of the Department of Housing and Urban Development notes that interstate highways. . . will affect future urban growth patterns in ways and to extents not adequately recognized by policymakers." (56) Interstate highways are serving as the spine on which new development is occurring.

"Transportation is but one element in the physical system. It is the skeleton which shapes the physical form of the region." (57) This quote from the A. D. Little study of transportation planning in New Orleans brings home the relationships between highway planning and the future growth of an area. Thus, highways are a management tool and their placement and design should be viewed in this light. Expansion of industry and urbanization into wetlands can, in large measure, be traced to highway systems which grant access to the area.

Placement of highways can be an important tool in managing growth by directing it into areas which are suitable for additional growth. Wetlands are not as suitable for growth as some other areas because of the potential adverse impacts on fish and wildlife resources, the increased costs of building and maintaining structures and services on organic peaty soils and the subsidence and drainage problems.

If a highway must go into or across a delicate ecological area, it should be designed with the needs of the social and natural environment in mind so that its impacts are minimized. An example of such a design is the section of Interstate 10 between Jefferson Parish and LaPlace, Louisiana. The highway is elevated on pilings and interferes marginally, if at all, with the flow of water and nutrients between Lake Pontchartrain and the cypress swamps on the landside.

An example of a bad design is illustrated by the following quote from the National Estuarine Pollution Study:(58)

"The construction of a highway through the coastal area of Louisiana and Mississippi effectively separated the inland areas of the coastal marshes from the outer marsh areas, completely altering the circulation patterns of the entire marsh system. The result has been saltwater intrusion into the outer marsh system (in the absence of the freshwater inflow from inland sources now prevented by the highway) with the subsequent results of soil alteration and eventual alteration of the marsh vegetation."

The essential difference in these two highways is one of design. The former was elevated on pilings; the latter was built on an artificial embankment.

Evacuation routes, on occasion, have become the center of controversy. Although legitimate needs exist to provide roads for evacuation in times of danger, it should be recognized that the routes often become access corridors for development. If the route is planned for evacuation, it should be designed for that purpose alone.

Commission Recommendations Concerning Highways

The commission recommends that highways follow natural highland corridors whenever possible. Where they do not, they must be built in a manner to minimize environmental impact, e.g. on pilings to minimize water flow disruption. In addition, interchanges or exits must not be constructed in environmentally sensitive areas such as undisturbed or undeveloped wetlands. In areas of scenic beauty, there should be facilities for "scenic outlooks," with descriptive signs explaining the pertinent features of the landscape. These "scenic outlooks" must be compatible with the environment.

In the past, evacuation routes have served as access for development although they were built primarily as escape routes from storm surge. Viewed in this light, the routes increase the danger of flood damage to people by causing greater population movement into areas which are flood prone. The Commission recommends that construction of evacuation routes be restricted severely so as to benefit those people clearly endangered because of living in a flood-prone area. New highways in the coastal zone should be high enough to avoid early flooding which would make them inoperative before the major portion of the storm hits. Where necessary, existing roads should be upgraded but kept in the same roadway for use by residents.

c. Air Transportation

Airport site selection potentially has the most significant impact on wetlands. With the majority of the population living close to the coastal zone, the demand for air travel and airports has prompted proposals for jetports in wetland areas e.g., in Lake Pontchartrain and the Florida Everglades. Because large airports cover large acreage and the indirect, but related, effects of access highways to the airport can have substantial effects on wetlands environments, airport sites should be considered carefully. The concept of airports which serve regions rather than a single city is gaining in acceptance.

Commission Recommendations Concerning Airports

Major new airports should be excluded from water, wetlands, swamp and marsh sites. They should be built on high ground in upland areas or on other natural high elevations. Concurrent with airport planning, there should be land-use planning for development accompanying the airport. The development should be planned to complement the airport and blend in with the area. Wherever possible, rapid transit should be part of the airport plan so as to reduce reliance on the automobile and provide better access. This concept is especially applicable to the regional airport being considered for the area between Baton Rouge and New Orleans.

8. Future Industrial Growth

The Commission has reviewed several aspects of future industrial growth and its relationship to wetlands. The complexity of the subject prevents detailed analysis at this time.

a. Industrial and Power Plant Siting

The siting of power generating plants has aroused controversy across the country. Several power plants are being planned for Louisiana, some of them in the coastal zone. At present, Louisiana has no policy regulating the location of power plants.

As an alternative to locating industry in the coastal zone, it has been suggested(59) that industrial complexes be situated on waterways in upland areas. These complexes would have the corresponding necessary transportation systems, pollution control systems, closed water cycle systems, space, area, etc., necessary for efficient operation. An advantage, if the density of industry became high enough, would be centralized pollution control systems, water recycle systems, etc., for all the industries to use. The other principal advantage would be that the industrial complex could be situated on inland waterways, where they would be more compatible with the environment. Near the industrial complex would be "people cities," within reach of the complex by sound transportation systems, where workers would live.

Commission Recommendations Concerning Power Plants

The Commission recommends that the state, through the appropriate agencies, establish a state policy for siting power plants. The Commission further recommends that: (1) new power plants not be situated where the heat from the plant would adversely affect estuarine areas, e.g., on low volume streams; (2) power plants in areas with brackish or saline waters have condenser systems in tandem so that one can be utilized while the other is being cleaned, thus enabling them to operate on an on-off basis and to eliminate the use of harsh chemicals in condenser waters to prevent growth of marine organisms; (3) existing and future federal and state regulations concerning effluents from power plants be vigorously enforced; and (4) hot water effluents from power plants be used innovatively as a heat source for aquaculture, residential heating, and so forth.

b. Diversification

A current concern within Louisiana is the state's policy regarding industrial growth, the tax base, and employment, as oil reserves in Louisiana territory become depleted. Revenues derived from petroleum production are beginning to decline with further decreases in sight as production moves farther off-shore.(60) Many knowledgeable observers have urged officials of the state to attempt to diversify the state's industrial base so that the effect of the decrease of any one activity will be minimized.

Commission Recommendations Concerning New Industries

The Commission recommends that the state make a determined effort to diversify and expand its industrial and economic base. To accomplish this, the Louisiana Department of Commerce and Industry or other agencies should (1) develop a program to identify the kinds of commercial enterprises related to Louisiana's indigenous living resources within the coastal zone, (2) identify manufacturing facilities related to or dependent upon a superport development, and (3) institute a program to maximize diversification of industry to those not necessarily dependent upon mineral resources, insuring compatibility with the environment to the maximum extent possible.

B. Coastal Zone Management

Coastal zone management has two major components, which can be viewed separately although they are necessarily complementary--(1) long-range planning and research and (2) day-to-day management coupled with applied planning.

Long-range planning and research is necessary to develop an overview of coastal zone resources use to enable government to make better policy decisions. Basic data which provide the scientific and technical base for the planning process must be rendered by long-term research programs in universities or research institutes.

Day-to-day management is necessary so that the business of coastal zone resource use can proceed orderly. Applied planning can help the resource manager make wise decisions by furnishing the decision maker the best information available. Applied planning is, in turn, technically supported by short term, timely, solution-oriented research conducted by the managing agency, not-for-profit organizations and others.

1. Long-Range Planning and Research

Long-range planning can produce insights into resource allocations necessary for maximizing benefits and minimizing costs to the people of the state. Some of the components of long-range planning are examined below.

a. Intrinsic Suitability

The coastal zone of Louisiana contains many different kinds of landscape, e.g., swamp, marsh, open water, natural levees, prairies and highlands. Each of these types of terrain is suited for some kinds of uses and unsuited for others. Determination of the best uses for any area results from studying the natural physical characteristics, e.g., soil type, elevation, rainfall flood probability, foundation conditions, etc., of the area. After data relating to physical characteristics of an area are collected and plotted on maps, recommendations about the most suitable uses of an area are made. Then, color-coded maps which reflect these recommendations can be prepared for all planners, public or private. The process, called intrinsic suitability mapping, is being used in many states, including Florida, Texas and, to some extent, Louisiana. Decisions aided by such a process normally results in increased benefits and minimized costs.

b. Cumulative Effects

An important function of long-range planning is to determine the aggregate or cumulative effects of many small, seemingly isolated, projects or actions on ecosystems. An individual project may have little impact on the ecosystem while hundreds of such projects may have an overwhelming impact. Yet the projects are permitted one at a time over a period of years. The resource manager may have no reason for restricting any single project since he cannot foresee the cumulative affect. For this reason, long-range planning must develop mechanisms for predicting and anticipating cumulative effects on an ecosystem basis. Rarely does one of anything, such as an oil well, industrial installation or housing development, have a measurable adverse impact on the whole ecosystem; rather it is the cumulative effects of all these actions which are hard to measure and perhaps most destructive.

As a remedy to the problem, competent and well-informed people have requested a moratorium on selected activities in the coastal zone until we learn how to manage it. Other states (e.g., Texas in the case of the sale of their state-owned submerged lands and California in the case of dredging in their estuaries) have imposed moratoria in their coastal zones. Injunctive procedures (like those which caused the cancellation of the sale of oil leases in tracts offshore from Louisiana in 1971) might result in a moratorium in Louisiana's coastal zone if the state does not resolve the conflicts between coastal resource users.

Commission Recommendations Concerning Cumulative Impact of Projects

The Commission recommends that the appropriate state agencies responsible for long-range planning and coastal zone management consider the cumulative or aggregate effect of all projects and activities planned for the coastal zone and determine how many can be completed without adversely affecting the coastal ecosystem. When the point is reached such that additional projects or activities will irreversibly alter the ecosystem then projects should be reevaluated and reasonable limits to growth in wetland areas could be set.

c. Transportation Planning

Currently, transportation investment decisions are made by independent single-mode agencies or special districts at the state, regional and local levels. The State Highway Department has an assignment with a single purpose--highway construction. The existence of many such single-mode agencies hampers the effective integration of transportation planning with other community planning and hinders coordination of the various modes. Regional planning agencies, which in theory are responsible for developing area-wide transportation plans as part of their comprehensive planning process, have been largely ineffective because of a shortage of funds for planning, and a lack of authority to implement plans they develop.

As the economic, social, environmental, and energy costs of automobiles mount, demands for mass transit become more insistent, especially in urban areas. Proposals have been made for some modes of mass transportation between Baton Rouge and New Orleans and between New Orleans and the area north of Lake Pontchartrain but these are not even in the planning stage. The State Planning Office notes: "It is probable that New Orleans will also ultimately look to mass transit solutions because this city has built-in restraints to a free flowing highway system, in the form of its many water barriers."(61)

Commission Recommendations Concerning Transportation Planning

The Commission recommends that a state Department of Transportation Planning be created and that this department, in coordination with and subject to approval of the Louisiana Coastal Resources Commission and other appropriate agencies, develop a continuous comprehensive, state master transportation plan for Louisiana, analyzing all modes of transportation, with primary emphasis on development of an integrated mass transit system for major metropolitan areas, such plans to become a part of any and all comprehensive state or regional planning. The State Planning Office's current statewide transportation study could provide the basis for such a plan. The Department of Transportation Planning should have a section to plan for and investigate the feasibility of rapid transit in Louisiana.

In addition, the Department of Transportation Planning would provide state-level policy guidance and expertise for transportation agencies and regional planning bodies. In turn, regional and metropolitan planning agencies should include long-term objectives as well as annual project plans in their transportation programs and be specific in justifying the projects they propose.

Further, the State Highway Department and other agencies involved in highway construction and planning should plan highways on a comprehensive (and regional) basis, using comprehensive plans which interrelate all modes of transportation.

The Department of Transportation Planning could be established in several ways: (1) as a subdivision of the Louisiana State Planning Office, (2) as an interagency council which would include members of all transportation agencies in the state and (3) as a cabinet level Department of Transportation Planning.

d. Key Facility Land Use Planning

Key facilities are large installations which serve to generate additional growth. Examples include airports, ports and superports, industrial plants, electrical generating plants and large recreational facilities. Because the installations generate growth, they function as a nucleus for further expansion. If the expansion is unplanned, it may detract from the facility.

Commission Recommendations Concerning Key Facilities

The Commission recognizes that secondary or ancillary development which follows a key facility, such as an airport or a superport, can have long-term impacts greater than the impacts from the key facility itself.

For this reason, the commission recommends that land-use planning for the area around the key facility proceed simultaneously with key facility planning.

e. Open-Space Planning

Open space refers to undeveloped areas such as parks, green belts, etc., which are left relatively undisturbed for recreational and aesthetic purposes. In an urban setting, they provide a respite and an alternative to the glass, steel and concrete of the city. In a rural setting, open space can be the basis of a state park system.

Commission Recommendations Concerning Open Space

The Commission recommends that an open-space state-level policy be adopted and notes that a well-designed, open-space program can be a key to resolving major land-use conflicts. If implemented with vigor, such a program could preserve lands to supply resource needs, insure maintenance of public safety by preventing development of geologically or environmentally hazardous areas, help meet recreational demands, halt urban sprawl, provide direction for urban growth, and serve to implement sound planning principles more easily.

More specifically, the Commission recommends that:

1. The state adopt an open-space land-use policy by executive order or legislative decree. This policy would formulate criteria to guide an open-space program, delineate areas of responsibility at different levels of government, outline broad categories of land-use which should be preserved, and establish priorities for open-space preservation.

2. The Office of State Planning prepare, as soon as possible, a State Open-Space Plan, which will do the following:

- a. Classify state lands into open-space categories by utilizing environmental considerations.
- b. Indicate those areas which should remain as open space.

- c. Designate lands sufficiently important to the state to require direct and immediate action to protect or preserve them.
- d. Outline a program and financial requirements necessary to implement the plan.

3. Local or regional planning and governing bodies should adopt open-space zoning ordinances to include provisions such as those in No. 2 above, and insure full enforcement of them.

f. Lake Pontchartrain Planning

Lake Pontchartrain, the state's largest lake, is unique in that it is also part of an estuary and serves the recreational needs of a large urban area on its shores. It is of added value because of shell and sand dredging and mineral extraction. Many pressures prevail for use and development of the lake, with dozens of projects planned, proposed or executed. Currently, the State Land Office has received applications to dredge and fill parts of the lake for reclamation purposes.

Despite a general constitutional provision prohibiting the state from transferring titles to state-owned waterbottoms, there is at least one exception, in that some of the parishes bordering on Lake Pontchartrain have the constitutional right to acquire title to acreage in the lake through the reclamation process. At present, proposals have been made to fill portions of the lake touching Jefferson and St. Charles parishes. Each of these proposals must be approved ultimately by permit from the U.S. Army Corps of Engineers before dredging and filling can begin, and adoption of an acceptable environmental impact statement must precede issuance of such a permit.

It is conceivable, of course, that a Corps of Engineers permit would not be issued in a given instance. Nevertheless, the Commission feels that legal measures which give right of reclamation to parishes bordering on the lake may not be in the best interest of the state and may contribute to abuses of the lake as a natural resource.

Commission Recommendations Concerning Lake Pontchartrain and Other Louisiana Lakes

The commission recommends that the Coastal Resources Commission be authorized to inventory and study, on a continuing basis, all uses of the lake by man and to set a limit, from time to time, on the amount of dredging and filling which can occur in the lake. In this way, the environmental viability, biological productivity, and recreational usage of the lake can be maintained indefinitely for the citizens of Louisiana.

The Commission further recommends that all Louisiana lakes which have been surveyed and meandered, are close to heavily populated areas, are used for recreation, and have waterbottoms owned by the state, receive similar consideration in order that maximum benefit from use of Louisiana's lakes can be derived with the least environmental damage.

g. Basic and Long-Term Research

Long-range planning must be supported by research which provides (1) a fundamental understanding of complex coastal zone ecosystems and (2) valid techniques for predicting economic and environmental impacts, singly and in concert, of a diversity of activities and developments proposed by man. None of these capabilities or goals can be achieved without knowledge obtained through research and sufficient numbers of well-trained personnel to implement and conduct needed activities. The Commission believes that the present level of knowledge concerning Louisiana's coastal zone, and the number of trained personnel actively engaged in well-organized or focused marine and coastal programs are totally inadequate to satisfy public needs.

Universities have the capacity to take a long-range and comprehensive look at coastal and marine problems, conduct thorough analyses of available data and maintain awareness of scientific and technological advances. Although universities cannot and should not make management decisions regarding Louisiana's coastal zone or marine resources, they can and should document needs and provide capabilities that will encourage state agencies to implement and enforce programs essential for optimum development of these areas and resources.

Commission Recommendations Concerning Long-Term Research

The Commission recommends that basic and long-term research necessary for long-term planning be provided by university-based programs.

The Commission believes the National Sea Grant Program provides an opportune mechanism to aid the universities in this role and recommends that every effort be made to maximize Louisiana's role in this program.

2. Day-to-Day Management of the Coastal Zone

In a coastal zone such as Louisiana's, with many uses occurring daily and simultaneously, continuous management is essential for sustaining many resource uses.

a. Permitting, Surveillance and Enforcement

Daily management of the coastal zone involves handling permit applications, surveillance of all coastal zone operations and enforcement of laws and regulations.

Permit applications received by the manager will cover a range of activities from the dredging of small ditches to the construction of vast navigation or flood control projects and will number in the thousands each year (at present the Louisiana Wild Life and Fisheries Commission receives approximately 2,200 permit applications per year). Each of the applications will require study, a knowledge of the area under consideration, possible modifications to the applicant's plans and a yes or no decision. To make the best decision, the manager will need maps which show the resources and physical setting of the area. He will also need to be able to predict the effect of the action, if permitted, and suggest necessary changes to the proposed project. This will require, in some cases, field personnel familiar with the area and boats and light airplanes to provide access in areas where there are no roads.

Once an action or project has received a permit to proceed, it will be necessary to monitor the progress of the project

to ensure that all rules and regulations are complied with. In addition, routine daily surveillance of the coastal zone will ensure that no unpermitted or unregulated activities cause unnecessary modifications. Surveillance will also require field personnel and the necessary means of access to the coastal zone, i.e., boats and airplanes.

The enforcement of laws, rules and regulations is the third major facet of the manager's daily responsibility. This is a necessary part of management and gives weight and meaning to permitting and surveillance. Enforcement requires close surveillance of permitted activities and is essential to good management.

The day-to-day decisions of the management authority must be timely and based on sound technical and managerial principles. Some of the principles and the ways in which they are developed are discussed below.

b. Applied Planning and Short-Term Research

Applied planning is short-range, solution-oriented and is designed to aid the decision-maker in matters affecting daily resources management. This type of planning often involves creating map displays of available resources, living and non-living, so that decision-making is facilitated and the effects of decisions can be assessed rapidly.

Applied planning is, in turn, supported by short term, timely, solution-oriented research which provides the technical base for planning and ensures that management decisions are based on sound scientific evaluation. Applied research is carried out best under the direction of the resources manager because only he is aware of his informational needs. This implies that short-term research personnel should be housed in the same working area as the manager.

Commission Recommendations Concerning Short-Term Research

The Commission recommends that in matters lacking sufficient research, the Office of Coastal Zone Management conduct adequate short-term research programs to assure efficient resources management.

c. Value of Wetlands

Making management decisions requires that the true value of viable wetlands be measured against the true value of a proposed project or action. In this way, management decisions serve the public interest.

Assessing economic values of viable wetlands is extremely important since the enormous recreational, commercial, and sports fisheries, and the general life support values of the living resources of the coastal zone are related directly to its marshes, swamps and waters. However, the difficulty of translating the values of natural or undeveloped areas into monetary terms has hampered severely efforts to protect the living resources of the coastal zone. For instance, although recreation is recognized as a legitimate land use, it is difficult to place a cash value on the aesthetics of an unspoiled wooded area or natural lake.

On the other hand, cost accounting techniques for industrial, commercial and residential development are well-established. There is nearly universal acceptance of valuation techniques which show the cash value of those particular management alternatives. A method must be developed for assessing the true value of wetlands to Louisiana. For example, a technique which places a monetary value on societal usage can be an important aid in land use management. Tidal marshes or wetlands are lands where the real beneficial values accrue some distance from the marsh itself. Scientists, for instance, have estimated that considerably more than half of the total production of organic matter in a Gulf Coast estuary originates in the surrounding marshes. These estuaries serve as a nursery ground for most important coastal fish and shellfish. Thus, coastal and sport fisheries are dependent on a viable and productive marsh as an integral part of the estuarine system. This is not the only valuable function of an undisturbed marsh but it is an important one. Even though the marsh may be privately owned, the production of that marsh does not, at present, accrue directly to the owner, but it may be necessary for the survival of commercial fishermen many miles away.

In testimony at the Morgan City hearing of the Commission, the Louisiana Wild Life and Fisheries Commission noted that "sport fishing and hunting combined provide over 9 million recreation efforts annually with an annual value of nearly \$92 million. At a 5.5 per cent interest rate, this represents a capital investment of 1.67 billion dollars." They further point out that in addition to this value for hunting and fishing,

Louisiana's coastal zone is of great value for other outdoor recreation, such as boating, nature study, bird-watching and photography, but that this value has not been assessed in dollars. These figures tend to indicate that the recreational value of the coastal zone is exceptionally high.

Commission Recommendations Concerning the Value of Wetlands

The Commission recommends that all federal or state agencies or special districts of the state, in pursuing any activity which would alter, disturb or destroy acreages of wetlands, include as a cost of the project (to be weighed against benefits), the realistic value of an acre of wetland. Environmental impact statements should contain an accurate assessment of costs and benefits of the project. The evaluation should include, but not necessarily be limited to, the following:

1. All values of the wetlands, including but not limited to, fisheries production, oyster production, water quality improvement, life support value and potential fisheries production, should be included in evaluating the worth of an acre of wetlands.

2. Dockside values of fishery and shellfish production should be multiplied by a factor (generally 2.5 to 3.5) in order to get true estimates of the worth of the resource after the value added for processing, canning and related activities.

3. One procedure for evaluating wetland acreage is to determine the annual yield in dollars from each acre of wetlands and then determine what quantity of money would be required to yield the same monetary return per year at the average percentage rate of return--usually 5 to 7 per cent. Florida has found that its wetlands produce an annual income to the state of approximately \$400 per acre. Capitalized at an annual rate of 5 per cent, this would mean each acre of marsh was worth \$8,000. There is good reason to believe the value of Louisiana marshes is comparable.

4. Another method for evaluating wetlands involves determining the annual return in dollars by using values like those listed in No. 1 above and then multiplying these annual returns by the life of the project (approximately 20 years). This method has yielded values of wetlands ranging from \$4,000 per acre to \$40,000 per acre.

The Commission further recommends that during the planning stage of projects which will disturb or destroy wetlands, research be initiated to determine the monetary value of the wetlands if it is unknown.

d. Positive Programs

In addition to the regulatory and permitting aspects of coastal zone management, the managing authority should sponsor and encourage positive programs to benefit the state.

1. Mariculture

Mariculture holds great promise as a new, labor-intensive industrial enterprise which could be compatible with and supportive of Louisiana's coastal zone. However, at present, this potential is largely untapped.

Commission Recommendations Concerning Mariculture

The Commission recommends a state policy which encourages active pursuit of new industries, mariculture, for example, related to Louisiana's unique environment. Pilot projects exploring the possibility of enhanced oyster, shrimp, crab and fin-fish production should be started with state or federal funding. Developing markets for under-fished species would raise fish industry income. For example, bluefish and crabs are in abundance in Louisiana but are under-utilized.

The Commission recommends that the Office of Coastal Zone Management, in conjunction with the Louisiana Sea Grant Program and other university programs and with the Louisiana Wild Life and Fisheries Commission, thoroughly evaluate

the economic potential of mariculture and initiate projects designed to evaluate the feasibility of various types of mariculture.

The Commission recommends that mariculture operations utilize existing waterbottoms or regularly flooded lands (e.g., rice farms) rather than large areas of biologically productive marshlands. In this way, mariculture represents a net gain in production and not merely utilization of already productive resources. It should be noted that cage culture at the present time is illegal in Louisiana, but some forms of cage culture could be legalized and regulated.

The Commission recommends that the Office of Coastal Zone Management sponsor studies investigating the use of certain canals such as pipeline canals and access canals which could be manipulated for multiple uses. Many of these canals which are closed at one or both ends with dams or weirs are clear, undisturbed by boat traffic, and highly productive. If accessible, these canals could function as sources of recreational fishing or areas suitable for mariculture.

The Commission does not recommend leasing of public water columns and/or water surface to individuals except for raft or cage culture. Water surface should not be fenced off from the general public. Impounding for mariculture areas currently accessible to the public would result in a decrease in access for recreation in the coastal zone.

The Commission recommends that water control structures be utilized to increase biological production. An example would be weirs at the opening of pipeline canals where they cross water bodies. This arrangement is highly beneficial if it allows ingress and egress of fish and crustacean larvae.

2. Water Resource Programs

Water resource management is a positive management program areas in which the Office of Coastal Zone Management should assume an interest. Two of these programs are of special interest. (For further discussion, see Chapter Six, Section Four).

a. Freshwater Introduction

The estuaries are becoming more saline as saltwater, aided by man-made channels, intrudes from the Gulf. In the past, saline water was pushed back by periodic flooding from the Mississippi and other rivers. However, levees have reduced substantially freshwater input into the estuaries.

Freshwater introduction programs would allow Mississippi River water to escape through or over the levee at various spots to restore freshwater/saltwater balance in the estuary. This probably would result in increased fisheries harvest.

b. Delta Building

In the past, the Mississippi River built up new deltas at the edge of the land mass. However, levees along the river to its mouth are causing loss of the river's silt load off the continental shelf.

Proposals have been advanced which call for judicious cutting of levees at selected spots, away from all civilization, allowing river water and sediments to flow to shallow bays and build new deltaic land masses.

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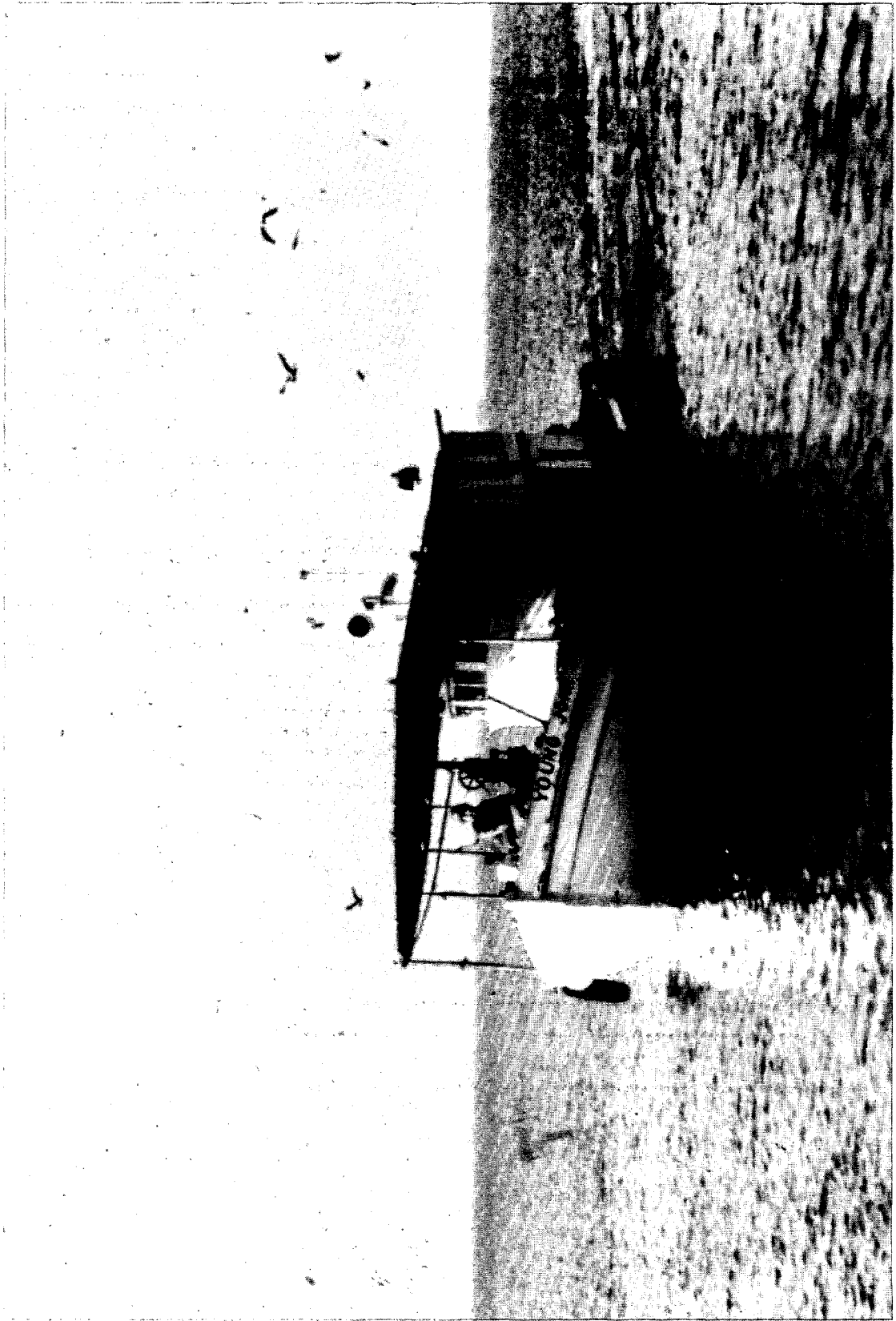
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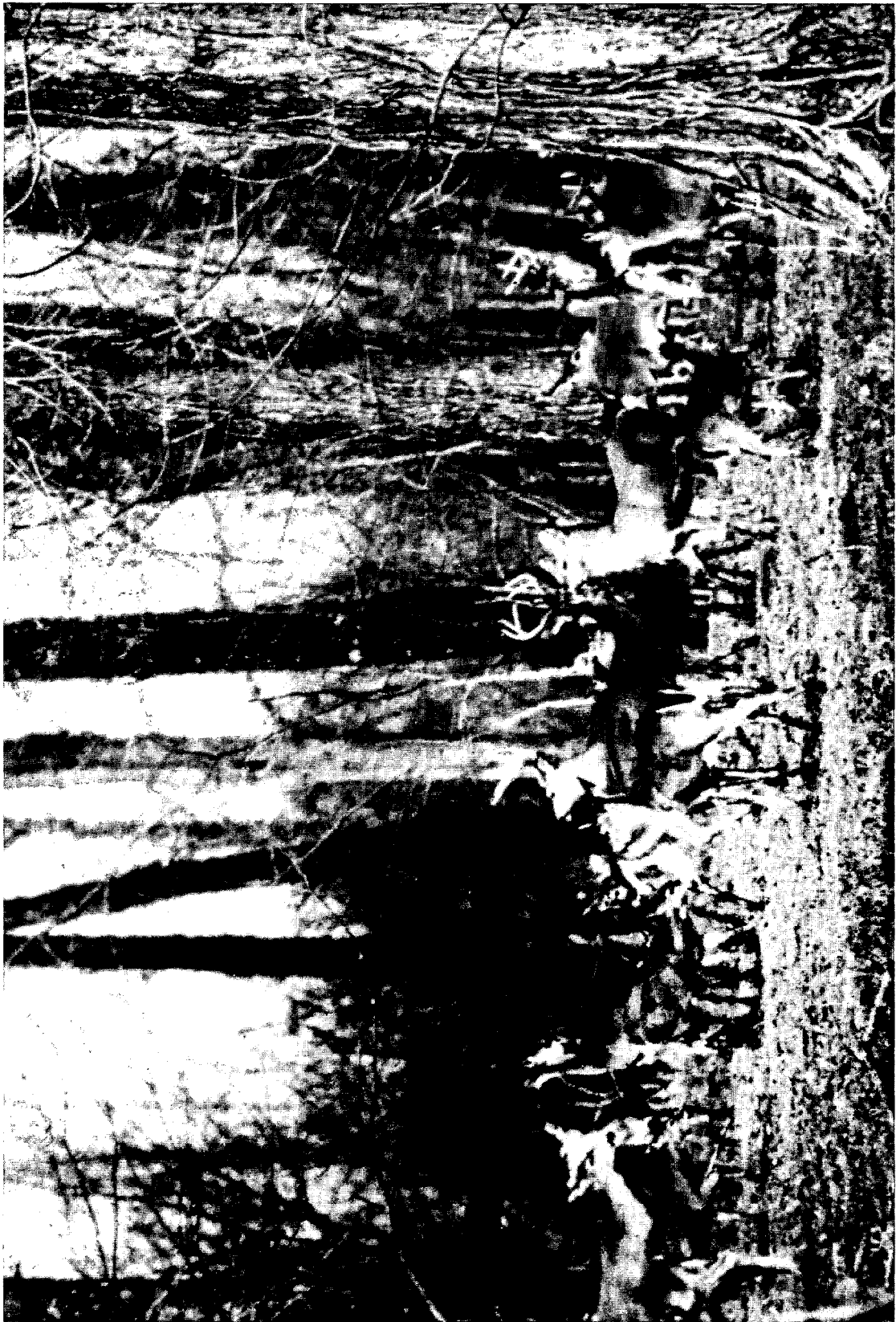
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CHAPTER FIVE

GOVERNING LOUISIANA'S COASTAL ZONE

The Need for a New Coastal Program

Because of the extensive wetlands and coastal waters characteristic of Louisiana's coastal zone, proper management practices are needed if Louisiana is to have an effective program for the long-range, orderly conservation and development of its coastal resources. Research, planning and management are necessary components of a new coastal zone program.

The Commission's study of wetland and coastal water problems has concluded that the coastal zone contains exceedingly complex systems impacted by a number of different kinds of stresses--both natural and man-made. To properly manage these areas and protect the living resources which they support a full understanding of the nature and effects of these stresses is needed. Research is a key to this understanding and a critical part of an effective coastal zone program.

Furthermore, various uses of coastal resources impact other uses and these uses tend to be interrelated. For example, waste from the production of mineral resources may, under certain circumstances, adversely affect fishing; navigation development may destroy animal habitats and impede hunting opportunities; and urbanization of wetlands may preclude recreational uses of these same wetlands. As a result of these interrelationships day to day decision-making practices are needed which view coastal resource use from the broadest possible perspective and provide a mechanism for resolving conflicts between the uses of coastal resources.

In the wetlands and coastal waters of Louisiana, rarely is one of anything--whether it be an oil well, the location of a particular industry, or a housing development--harmful to the entire system. An individual project may have little impact, while hundreds of such projects may have an overwhelming impact. Thus, it is critical that mechanisms and capabilities be developed to determine and assess the aggregate or cumulative effects of many small and seemingly isolated projects or actions on coastal zone ecosystems. Research, coupled with long-range planning, is needed to develop these mechanisms and capabilities.

Several of our coastal zone cities, particularly metropolitan New Orleans, are currently experiencing pressures to expand. Since in many instances these cities are ringed by wetlands, there is a tendency for expansion to occur into these wetlands. Urban sprawl into wetlands is undesirable because the soils often cannot support urban and residential development and the wetlands cannot be protected completely from floodwaters. Thus, in order to facilitate urban expansion in a logical and planned fashion, there is a great need for long-term planning and management practices that can direct urban expansion and growth into land and water areas intrinsically suited for such expansion and growth. Long-range planning would lead to management practices whereby heavy land uses such as for industry, commerce and residential development can be limited, insofar as practicable, to corridors and other areas intrinsically suited for development, instead of wetlands.

Hence, Louisiana needs a coastal zone program combining aspects of research, management and planning.

The Commission's 1972 annual report, Louisiana Government and the Coastal Zone--1972, found that Louisiana lacks clear cut state policies as to how coastal resources--air, water, minerals, fish, wildlife, recreation, land--should be used in future years. Consequently, the Commission found that officials responsible for making complex decisions regarding use of coastal resources are making those decisions in a "policy vacuum."

This "policy vacuum" exists because there is no existing statutory authority for coastal zone or wetlands management. Many state and federal agencies (e.g. U.S. Army Corps of Engineers, U.S. Soil Conservation Service, Louisiana Wild Life and Fisheries Commission, State Land Office, Department of Highways) make decisions regarding uses of the wetlands; however, Louisiana has no established statutory policies, standards, or criteria to ensure that these decisions are made in furtherance of the long-range best interests of the maximum number of people.

A corollary to the "policy vacuum" is the fragmentation of traditional natural resource management activities. Louisiana has statutes regulating most individual resources (i.e. fish, agriculture, ground water, oil, etc.). However, no statute regulates the interrelationships between the uses of those various natural resources. There are no procedures for resolving conflicts between these uses, for predicting or evaluating the social, economic, or environmental impacts or cumulative impacts of major coastal resources activities, or for integrating long-term research

findings and planning goals into the management process. Consequently, agency decisions are made on an individual and ad hoc basis with perhaps insufficient opportunity to consider long-range values, the effect on other beneficial uses of the coastal zone, and proper protection of the wetlands.

With a fragmented resource agency structure operating in a "policy vacuum" it would be difficult for the current state agency structure to implement a comprehensive coastal resources management policy. Each resource agency has its own particular mission. No existing agency is equipped to resolve conflicts between different user-groups. No one agency has any clear responsibility for an overall coastal zone program and hence, lines of accountability and responsibility to the Governor, the Legislature, and the public are obfuscated and often non-existent. Also, current research efforts and planning activities for coastal resource decision-making are decentralized and unorganized. What is needed is a high-level body in state government with adequate authority, funding, qualifications and information in order to provide the basis for a systematic and well-equipped coastal zone program.

A Recommended Institutional Arrangement (See Fig. 5.1)

The Commission recommends a model institutional arrangement it believes to be the most effective vehicle for implementing its substantive recommendations. A draft statute implementing this arrangement has been provided.

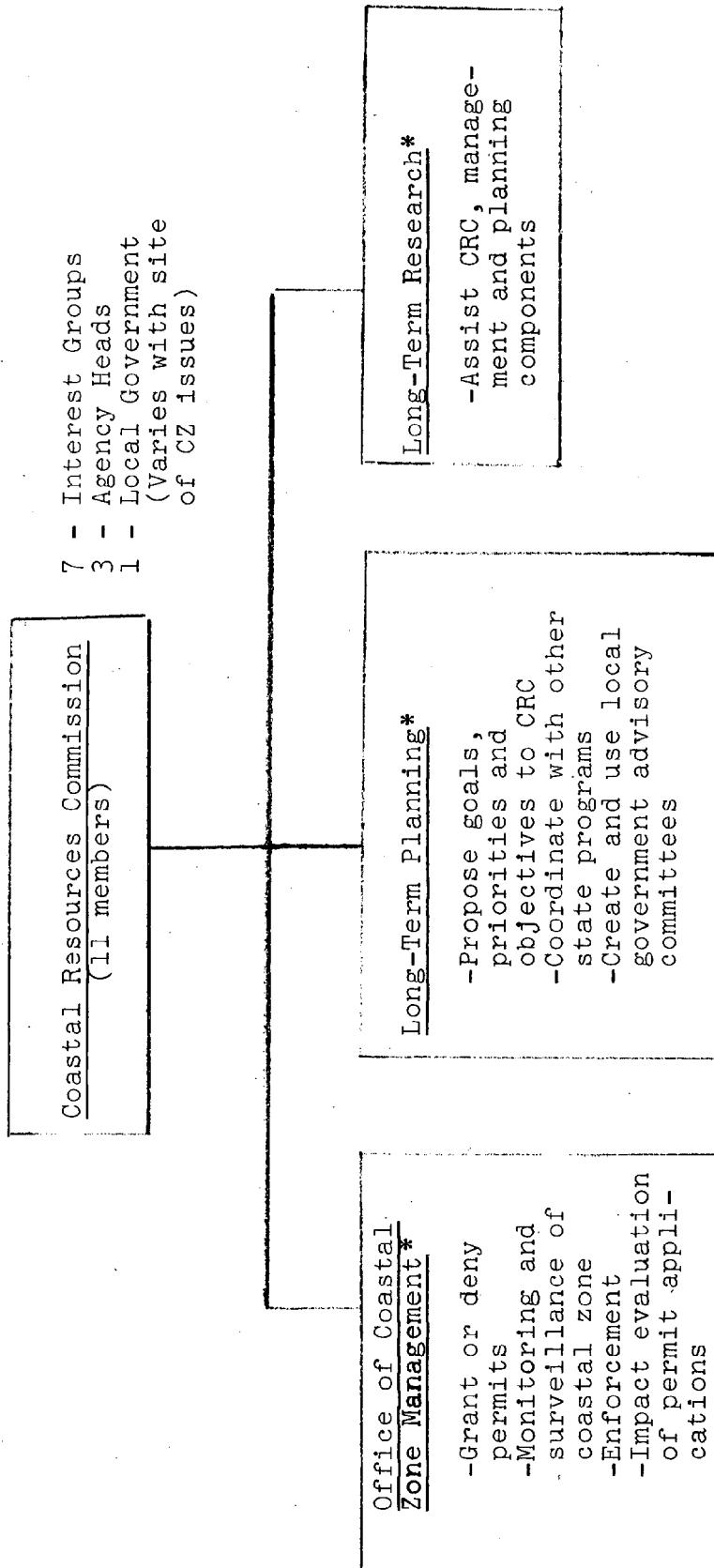
The draft statute establishes a coastal resource policy by setting forth legislative findings and declarations, criteria for decision making, and a permit system designed to implement the findings, declarations and criteria. The legislative findings and declarations, which set the theme for the entire coastal zone program are as follows:

"The Louisiana Legislature finds:

The coastal zone of Louisiana is the most valuable yet the most complex region of the state. Coastal and marine resources, including living resources, non-living resources, recreation, fish, wildlife, estuaries and water and land resources, are of vital importance to the people and economy of the State and there is a genuine concern throughout the State for their planned and coordinated development and protection.

Living resources of the coastal zone are directly dependent upon viable marshes and swamps

LOUISIANA COASTAL ZONE PROGRAM



*Recommended assignments (alternatives discussed in text)

Management - Louisiana Wild Life and Fisheries Commission

Planning - Office of State Planning

Research - Louisiana Sea Grant Program

Fig. 5.1

as integral parts of the estuarine systems. Increasing uses of the coastal zone for industrial and commercial development, water resources development, recreation, tourism, urbanization, and transportation are creating conflicts between these uses. These conflicts, if not reconciled, may diminish the natural capacities of the estuaries to provide habitat for many species of marine life and wildlife, produce nutrients essential to estuarine productivity, serve as a buffer against flooding and erosion of highlands, and aid in the assimilation of pollutants in the coastal zone.

Development should not be prohibited in the coastal zone. However, it is in the public interest and general well-being of the people of Louisiana and within the police power of the State to establish the proper balance between development and conservation.

The Legislature therefore declares:

That a planned, coordinated and concerted program should be conducted by state government in conjunction with local governments to prevent the harm from uncoordinated and ill-planned development of the state's coastal zone, both public and private.

It is further declared that it is the policy of the State of Louisiana to provide for the systematic and regional management of the state's coastal zone by planning for and encouraging all reasonable and compatible uses and by discouraging unreasonable and incompatible uses."

In order to implement this basic policy, the statute establishes a permit procedure under which no person (broadly defined as including any legal entity) shall make any use of lands or waters within the state which may measurably alter or adversely affect the coastal zone without first obtaining a permit. Before the Administrator can issue a permit, he must conduct a thorough evaluation of the proposed use fully considering a number of criteria, which criteria further amplify the policies expressed by the legislative findings and declarations. The criteria which must be considered are as follows:

A. In evaluating applications for permits for significant uses as defined by Section 2(H) the Office of Coastal Zone Management and the

Coastal Resources Commission shall fully consider all pertinent environmental, social, legal, economic and other criteria and the findings, declarations and purposes expressed by Section 1 of this Act.

B. The following shall be discouraged:

1. Uses which would cause adverse effects on living resources productivity, adverse ecological effects, and other long-range adverse effects.

2. Heavy industrial or commercial development and urbanization which would cause the permanent alteration of the natural characteristics of estuarine systems or which would take place in substantially undisturbed wetland areas.

3. Uses which would precipitate or induce secondary impacts and developments which would result in inconsistency with the criteria enumerated in this section or incompatible uses as defined by Section 2(E).

4. Uses which would require additional flood protection works to be constructed in undisturbed or substantially undisturbed wetlands.

5. Uses which would impose restrictions on public access or use of recreational coastal resources, unless the public access or recreational use would be detrimental to the environment.

6. Uses which would unduly burden sewer and solid waste disposal facilities.

7. Uses which would take place on soils intrinsically ill-suited to adequately support those uses.

8. Uses in areas where there are habitats for rare or endangered species of wildlife, or unique or irreplaceable historical or archaeological sites, or aesthetic amenities particularly unique to Louisiana's coastal zone.

C. The cumulative impacts of uses and proposed uses on the estuarine systems shall be thoroughly and specially considered. When the point is reached such that additional significant uses will alter natural capacities of estuarine systems, then additional significant uses shall be prohibited.

D. Economic effects, including the number of jobs created and the income which will be generated by the wages and salaries of those jobs, the amount of tax revenues potentially accruing to state and local governments, and the need for increased governmental services to support the developments shall be fully considered.

E. In addition to the statutory criteria enumerated in subsections (A) (B) (C) and (D) of this section, the Office of Coastal Zone Management and the Coastal Resources Commission shall fully consider all rules, regulations, criteria, and standards promulgated by the Coastal Resources Commission.

After the evaluations have been conducted and all of the criteria have been fully considered, the Administrator shall grant or deny the permit, impose conditions on the granting of the permit or refer the matter to the Coastal Resources Commission. He may deny the permit or impose conditions upon the granting of the permit if he makes a finding that the proposed use or the proposed use without conditions would be inconsistent with the applicable criteria and "incompatible." An "incompatible" use is defined as one which either causes a major permanent alteration of the natural characteristics of estuarine systems or which significantly interferes with or precludes other uses adjacent to or contiguous with the same geographical area.

The draft statute vests administrative and functional responsibility in three different agencies (i.e. an office of Coastal Zone Management, a long-term planning agency, and a long term research agency) with ultimate authority, responsibility, leadership, and coordinating functions vested in a combined inter-agency and private sector body called the Coastal Resources Commission.

Coastal Resources Commission

The Coastal Resources Commission would coordinate the three functions--planning, management, research--and integrate them into an overall Louisiana Coastal Zone Program. The Commission would provide overall supervision, guidance, direction, and decision making with respect to the Program. The membership of the Commission would be representative of private sector groups having interest in the coastal zone, state agencies, and local governments. The Administrator of the Office of Coastal Zone Management, the director of the

research agency, and the director of the planning agency would be ex-officio members of the Commission. In addition the Governor would appoint, subject to Senate confirmation, seven additional members who would be chosen, one each, from the following interest groups: oil and gas, fisheries, landowners, transportation, labor, agriculture and conservation. The conservation member must be chosen for his recognized leadership and interest in protecting the coastal environment. In addition to the ten regular members of the Commission, with respect to each hearing the Commission conducts on a contested permit application, the chief officer of the local government where the proposed use would take place would be an ad hoc member who would have full voting rights with respect to that particular application.

In carrying out its broad mandate of supervision, guidance, direction, and decision-making with respect to the Louisiana Coastal Zone Program, the Coastal Resources Commission would have broad authority. This authority would include:

- the promulgation of such rules, regulations, criteria and standards as may be necessary to properly manage the coastal zone or appropriate to comply with federal requirements.
- to hear and rule on contested permit applications in an appellate-like procedure.
- the establishment of goals, priorities, and objectives for the Louisiana Coastal Zone Program.
- budgetary supervision of the three functional agencies to ensure that financial allocations are made in accordance with the goals, priorities, and objectives of the Louisiana Coastal Zone Program.
- acquisition or recommendation of acquisition of interests in real property by donation, purchase, lease or exchange, and utilization of the property as beaches, sanctuaries, refuges, or other areas necessary for coastal zone management.
- acquisition or recommendation of acquisition of interests in real property by voluntary means or eminent domain for the use as "coastal and marine sanctuaries". A "coastal and marine sanctuary" is narrowly defined as "research area of limited acreage within the coastal zone of Louisiana having characteristics unique in relation to other areas or features of the

coastal zone of Louisiana and constituting, to the extent feasible, a natural unit, which is set aside for the purposes of scientific observation, research, and experimentation."

Further, in order to consolidate coastal resource regulatory functions in the Coastal Resource Commission and to achieve uniform resource policies in the coastal zone, it is provided that no rules, regulations, criteria, standards, ordinances, or resolutions intended to have the effect of law with respect to significant uses of the coastal zone shall become effective unless approved by the Coastal Resource Commission.

Management--The Office of Coastal Zone Management

The Office of Coastal Zone Management would be responsible for day-to-day management. The Office of Coastal Zone Management would work under the supervision, guidance, and direction of the Coastal Resources Commission and would coordinate closely with the other two functional agencies--the planning agency and the research agency.

The Office of Coastal Zone Management would be under the supervision and control of an administrator employed under the Louisiana Civil Service Laws by the Director of the agency to which the office is assigned with the advice and consent of the Coastal Resources Commission. The administrator must have exceptional professional qualifications, expertise, and experience with regard to the management of natural resources.

The primary responsibility of the Office of Coastal Zone Management would be to receive, evaluate, and make decisions regarding applications for permits for significant uses of lands or waters which measurably alter or adversely affect the coastal zone.

In order to facilitate its work in making permit decisions, the Office of Coastal Zone Management would be authorized to conduct short-term planning and research; to require modifications in proposed uses as conditions to the granting of permits, including steps to minimize or mitigate adverse impacts of the proposed uses; to conduct investigations and studies; to systematically monitor and conduct surveillance of significant uses which have been permitted to ensure that conditions of permits are fully complied with; and to seek civil and criminal enforcement measures for violations.

The Commission recommends that the Office of Coastal Zone Management be attached to the Louisiana Wild Life and Fisheries Commission.

The Wild Life and Fisheries Commission has been "managing" the coastal zone for many years as an additional responsibility beyond that of the management of specific fish and wildlife resources. This has been done without specific statutory authority or guidance. Considerable experience, expertise and capabilities in understanding the functioning of estuarine systems has been developed for fisheries management--types of gear, dates for fishing seasons, etc. Several of the resource scientists within the Louisiana Wild Life and Fisheries Commission are nationally recognized experts in coastal and marine biology and ecology. The Commission believes that this expertise should be fully utilized in any coastal zone management program.

In addition, the Louisiana Wild Life and Fisheries Commission has currently a coastal zone surveillance and monitoring program. The field personnel, equipment and procedures of the fisheries management and coastal zone management efforts should complement each other. The Enforcement Division of the Louisiana Wild Life and Fisheries Commission is subdivided into regional districts--three of which, and part of the fourth, are within the coastal zone. Each district contains field personnel operating in enforcement, biological, administrative and supervisory capacities.

In addition, the Louisiana Wild Life and Fisheries Commission has several programs, such as water pollution, biologic research, operation of fish and game preserves, leasing of state-owned waterbottoms for oyster culture, etc., which should be closely integrated with the work of the Office of Coastal Zone Management to implement an effective coastal resources management policy.

Alternative Agency Assignments for Management

Although the Commission recommends that the Office of Coastal Zone Management be attached to the Louisiana Wild Life and Fisheries Commission, there are alternatives. The State Land Office is one example. The Land Office is concerned with maintaining records regarding public lands, granting rights-of-way across state-owned lands, collecting royalties from mineral production, etc. The Land Office's lack of experience in water quality management, plus the absence of scientific and field personnel within the agency, would require an expensive and disruptive overhaul of the operations of the Land Office, should management responsibilities be given to this agency.

A second alternative is the Department of Public Works. The Department of Public Works is responsible for water resources development, navigation improvement and flood control. As such, the Department is not a regulatory agency, but a development and engineering services agency. Since the management component of the coastal zone program would be essentially regulatory, there may be a conflict of interest between the regulatory and development functions should the Office of Coastal Zone Management be attached to the Department of Public Works. In addition, the Department of Public Works does not presently have the personnel or equipment to evaluate the impacts of proposed coastal zone uses on fish, wildlife, estuarine productivity, and environmental quality.

Assignment of management responsibility to the Conservation Department is a third alternative. The Conservation Department's primary responsibility is to enforce rules and regulations concerning the production of mineral resources within the state. The management of other coastal zone resources--estuaries, fish and wildlife, recreation, water quality etc., may conflict with their duties in managing the conservation of oil and gas resources.

A fourth alternative is to vest management responsibility in local governments. Under the Commission's recommended institutional arrangement, local governments and state government will work together in a cooperative fashion and authority will not be totally vested exclusively at either level. However, for important legal and policy reasons that are more fully discussed subsequently, the Commission believes that the principal management decisions should be made at the state level.

Long-Range Planning

The second functional division of the Louisiana Coastal Zone Program, long-range planning, would be concerned with the broader questions of coastal zone resource policy that transcend day-to-day regulatory decision making. The planning function of the coastal zone program would recommend long-range coastal zone management goals, objectives, and priorities to the Coastal Resources Commission, to the Office of Coastal Zone Management, to the Legislature, and to the Governor. This function would recommend research needs, synthesize research and other data into a form usable by the Office of Coastal Zone Management and integrate long-range coastal zone goals, objectives and priorities with other goals, objectives and priorities of the State of Louisiana.

Under the draft statute the long-range planning function would seek the active participation of local and regional agencies in coastal zone planning by creating local government advisory committees composed of representatives of regional planning commissions and/or local governments. In addition, full public participation in coastal zone planning would be promoted. The planning function would continually assess the Coastal Resources Commission's program and recommend changes where appropriate to conform with federal guidelines. In so doing, they would develop a list of all permissible uses of lands and waters of the coastal zone, a continuing inventory of the resources and land and water uses of the coastal zone and a set of broad guidelines on priority uses for specific geographic areas within the coastal zone.

The Commission recommends that the Office of State Planning be responsible for long-range planning under the Louisiana Coastal Zone Program.

The Office of State Planning is responsible for overall state-wide planning and would be in an ideal position to properly integrate coastal zone planning goals and priorities with other state planning goals and priorities. Since the Office of State Planning is a part of the Executive Office of the Governor, executive leadership and direction for the state's coastal zone program would be facilitated. Also, the Governor would be in a better position to receive continuous inputs as to the progress of the state's coastal zone program.

Although the Commission has recommended that coastal zone planning be the responsibility of the Office of State Planning, an alternative would be to assign the responsibility to regional planning commissions. The Commission believes that regional planning commissions have an extremely important role to play in coastal zone planning, but that ultimate responsibility for planning must reside at the state level so that coastal zone goals and objectives can be integrated with other state-wide goals and objectives, and the state's coastal zone program can receive state-level and executive leadership and direction. Regional planning commissions, however, have done considerable planning and have collected much information and data. This information should be used by the Office of State Planning. The use of advisory committees to receive input from regional planning commissions and local governments on an ongoing basis should encourage the development of a cooperative state-regional-local coastal zone "planning process".

Research

The third function of the Louisiana Coastal Zone Program would be long-term research.

The Commission recommends that the long-term research function be carried out by the Louisiana Sea Grant Program.

The Louisiana Sea Grant Program is a university based and federally supported (two-third federal, one-third state) research, advisory service, and educational program concerned with coastal and marine resources. Federally, it is administered by the National Oceanic and Atmospheric Administration (NOAA) of the United States Department of Commerce. On the state level, it is administered through the Louisiana State University (Baton Rouge) Center for Wetland Resources. The Louisiana Sea Grant Program, however, is a statewide program in which any university in the state can participate, funds permitting. In the past, Nicholls State University, the University of Southwestern Louisiana and Northwestern State University have participated.

The Louisiana Sea Grant Program has worked very closely with a number of agencies that have substantive coastal zone responsibilities, including the Louisiana Wild Life and Fisheries Commission, the Office of State Planning, the Superport Authority, and others.

The Louisiana Sea Grant Program is an ongoing program with many years of multi-disciplinary research and advisory service experience. Under the Commission's recommended institutional arrangement, the Sea Grant Program would be primarily responsible for coordinating long-term research under the general guidance of the Coastal Resources Commission. The Commission would ensure that the research was compatible with and responsible to planning and management needs and objectives. Thus, the federal program, and the financial support available from it could be utilized in a positive fashion as an integral part of the state's overall Coastal Zone Program.

The Commission believes there are no viable alternative assignments for the long-term research function. With existing fiscal and manpower limitations, the Commission believes that existing capabilities and established funding sources should be fully utilized. Other universities, and private consultants should assist in the research, but the coordination and direction should be vested in the Louisiana Sea Grant Program.

The Roles of State and Local Governments

Under the draft statute, both state and local governments have vitally important and complementary roles. The primary regulatory and overall planning roles would be assigned at the state level while there would be formal mechanisms for local governments to make inputs into the overall program on an ongoing basis.

It is necessary to vest primary regulatory responsibility at the state level for several important legal and policy reasons. Under Section 306(E) of the federal Coastal Zone Management Act of 1972 a state program, in order to qualify for federal funds, must provide state level authority and supervision over the coastal zone program by one of the following methods:

- (a) "state establishment of criteria and standards for local implementation, subject to administrative review and enforcement of compliance;
- (b) direct state land and water use planning and regulation;
- (c) state administrative review for consistency with the management program of all development plans, projects, or land and water use regulations, including exceptions and variances thereto, proposed by any state or local authority or private developer, with power to approve or disapprove after public notice and an opportunity for hearing."

In addition to the federal requirements there are important policy reasons for vesting primary regulatory responsibility at the state level. The Commission has learned that the uses of coastal resources and the impact of these uses on estuarine systems transcend parish boundaries. To properly plan and manage estuarine systems, there must be legal authority which transcends the jurisdiction of particular individual parishes. For example, portions of six parishes are in the Atchafalaya Basin, and portions of ten parishes are in the Maurepas, Pontchartrain, Catherine, Borgne estuary.

Moreover, historically, state government in Louisiana has had jurisdiction over use of state waterbottoms, which are prevalent in Louisiana's coastal zone, and certain public lands. State agencies are responsible for managing public resources with the interest of the entire state in mind. Local governments, on the other hand, would

tend to take more parochial viewpoints with respect to the management of waterbottoms and public lands, since their responsibilities extend only to residents of their locality. These views might not be in the best interest of the state's total population.

In addition, major commercial and industrial interests in Louisiana--such as the oil and gas industry and the water transportation industry--operate on a regional or state-wide basis. Consequently they must plan their operations on this basis and need rules and regulations which are uniform throughout the coastal zone.

Although the primary regulatory and overall planning goals would be assigned at the state level, local governments would have formal memberships on the Coastal Resources Commission, would have the power to recommend rules and regulations and would be responsible, through the vehicle of advisory committees, for ongoing input into the state planning and management programs.

The Management of Public and Private Lands and Waters

The Commission has learned that the impacts of resource uses on wetlands and coastal waters transcend ownership boundaries and are not confined only to public property. Thus, from a scientific standpoint, public and private lands and waters within the coastal zone cannot be managed separately.

It is fundamental in our society that one who owns property is entitled to use his property in any fashion he sees fit as long as his use does not interfere with the rights of other persons. If the uses interfere with the rights of other persons, states are constitutionally empowered under the police power to make and enforce reasonable regulations regarding land uses. In the context of the Louisiana coastal zone, the uses of particular wetlands and coastal waters, although privately owned, may have far-reaching effects on, for example, living resources productivity in water areas far removed from the site where the use takes place. Thus, there is a rational basis for reasonable regulation of the uses of private lands and waters within the coastal zone since the regulation is directly linked to the well-being of the citizens of the state.

It is singularly important, however, that regulations adopted be reasonable. Coastal zone landowners have the right to make reasonable use of their property and expect

reasonable economic returns. If this reasonable economic use is so abridged in pursuing the overall public interest such that a landowner is essentially denied the productive use of his property, then the landowner should be compensated as provided under existing constitutional and statutory laws.

In addition, coastal zone landowners have a right to know in advance the type regulations to which they must adhere. A clearly stated coastal zone program would meet this objective and would obviate the financial and other uncertainties of piecemeal regulations.

LOUISIANA COASTAL ZONE STATUTE

PART A: PURPOSES AND DEFINITIONS

Section 1. Legislative Findings and Declarations; Purposes

The Louisiana Legislature finds:

The coastal zone of Louisiana is the most valuable, yet the most complex region of the state. Coastal and marine resources, including living resources, non-living resources, recreation, fish, wildlife, estuaries and water and land resources, are of vital importance to the people and economy of the State and there is a genuine concern throughout the State for their planned and coordinated development and protection.

Living resources of the coastal zone are directly dependent upon viable marshes and swamps as integral parts of the estuarine systems. Increasing uses of the coastal zone for industrial and commercial development, water resources development, recreation, tourism, urbanization, and transportation are creating conflicts between these uses. These conflicts, if not reconciled, may diminish the natural capacities of the estuaries to provide habitat for many species of marine life and wildlife, produce nutrients essential to estuarine productivity, serve as a buffer against flooding and erosion of highlands, and aid in the assimilation of pollutants in the coastal zone.

Development should not be prohibited in the coastal zone. However, it is in the public interest and general well-being of the people of Louisiana and within the police power of the State to establish the proper balance between development and conservation.

The Legislature therefore declares:

That a planned, coordinated and concerted program should be conducted by state government in conjunction with local governments to prevent the harm from uncoordinated and ill-planned development of the state's coastal zone, both public and private.

It is further declared that it is the policy of the State of Louisiana to provide for the systematic and regional management of the state's coastal zone by planning for and

encouraging all reasonable and compatible uses and by discouraging unreasonable and incompatible uses.

Section 2. Definitions

For purposes of this Act:

A. "Administrator" shall mean the Administrator of the Office of Coastal Zone Management created herein.

B. "Coastal and Marine Sanctuary" shall mean a research area of limited acreage within the coastal zone of Louisiana having characteristics unique in relation to other areas or features of the coastal zone of Louisiana and constituting, to the extent feasible, a natural unit, which is set aside for the purposes of scientific observation, research, and experimentation.

C. "Coastal zone" shall mean the coastal waters, and the shorelands strongly influenced by the coastal waters and in proximity to the shoreline, including transitional and intertidal areas, marshes, swamps, natural levees and beaches within the following parishes: Acadia, Ascension, Assumption, Calcasieu, Cameron, East Baton Rouge, Iberia, Iberville, Jefferson, Jefferson Davis, Lafayette, Lafourche, Livingston, Orleans, Plaquemines, St. Bernard, St. Charles, St. James, St. John the Baptist, St. Mary, St. Martin, St. Tammany, Tangipahoa, Terrebonne, Vermilion, West Baton Rouge. The coastal zone extends seaward to the territorial limits of the state of Louisiana.

D. "Coastal waters" shall mean bays, coves, lagoons, lakes, inlets, sounds, estuaries, rivers, streams, bayous, or other bodies of water (including the beds and bottoms thereof) in direct connection with or which drain into the open sea or which have measurable salt content (under normal weather conditions over a period of years) or which are affected by the ebb and flow of the tide.

E. "Compatible use" shall mean any use which does not cause a major permanent alteration of the natural characteristics of estuarine systems and which does not significantly interfere with or preclude other uses adjacent to or contiguous with the same geographical area. An "incompatible use" is a use which is not "compatible."

F. "Estuarine system" or "estuary" shall mean a hydrologic unit having connection with the open sea, in which the sea water is measurably diluted with fresh water derived from land drainage.

G. "Person" shall mean any state agency, federal agency, regional agency, local governing authority, political subdivision, special district, individual, firm, association, partnership, corporation, trust, or any other legal entity. Provided, however, that federal agencies shall be subject to the requirements of this Act only when any concurrence, authorization, assistance, or matching funding is provided or required to be provided by any state agency, local governing authority, political subdivision, or special district of the State of Louisiana.

H. "Significant use" shall mean any use of lands or waters within the state which measurably alters or adversely affects the coastal zone. The following uses, but not by way of limitation, shall be significant uses: all uses which currently require a permit from the United States Army Corps of Engineers or which would be carried out by federal agencies, drainage and navigation projects sponsored by federal, state, or local governments, dredging for land-fill projects, dredging and navigation projects associated with mineral activities, pipelines and industrial construction, sand, gravel, and shell dredging, maintenance dredging, land fill and reclamation projects, the alteration of surface or ground water supplies, and water control structures. Provided, however, that construction on land not affecting water flow and water quality shall not be a significant use. The Administrator shall otherwise make the determinations as to what is and what is not a significant use.

PART B. ESTABLISHMENT OF THE LOUISIANA COASTAL ZONE PROGRAM

Section 3: Functional Programs of the Louisiana Coastal Zone Program

The Louisiana Coastal Zone Program shall consist of three functional programs--management, long-range planning, and long-range research. These functional programs shall be under the supervision, guidance and direction of the Coastal Resources Commission created herein.

Section 4: Supervision, Guidance, and Direction; the Coastal Resources Commission

A. There is hereby created the Coastal Resources Commission as an agency or arm of the State of Louisiana to provide overall supervision, guidance, direction, rule-making and decision-making with respect to the Louisiana Coastal Zone Program.

B. The Coastal Resources Commission shall have jurisdiction over all significant uses of lands and waters with the state as defined by §2(H).

C. The Coastal Resources Commission shall be composed of 10 regular members. The Administrator of the Office of Coastal Zone Management, the Director of the _____¹ (research agency), and the Director of the _____¹ (planning agency) shall be ex officio and voting members of the Commission, subject to §12(D). The Governor, subject to confirmation by the Senate at the next session of the Legislature, shall appoint seven (7) additional members for three (3) year terms. These members shall be selected one each from the following groups: oil and gas industry; transportation industry; organized labor; private conservation groups; coastal landowners; coastal agriculture; and coastal fishermen. The member chosen from private conservation groups shall be chosen for his recognized leadership and interest in protecting the coastal environment. Each member shall serve in an individual capacity and not as a representative of his respective employer or organization. Legislators shall not be eligible for appointment. Vacancies shall be filled by the Governor, subject to confirmation by the Senate as aforesaid.

D. Each member of the Coastal Resources Commission shall be a person who as a result of his training, experience, and attainments, is exceptionally well-qualified to analyze and interpret environmental trends and information, to appraise resource uses in light of the purposes of this act, and to be responsive to the scientific, social, aesthetic, recreational, cultural and economic needs of the State.

E. In addition to the ten (10) regular members of the Commission with respect to each appellate or referral hearing on an application for a permit, the chief officer of the parish (or in the case of Orleans Parish, the Mayor of New Orleans; or in the case of East Baton Rouge Parish, the Mayor President of Baton Rouge) where the proposed use would take place shall be an ad hoc member of the Commission and shall have all of the powers of a regular member with respect to that particular application. Provided however, that if a proposed use would involve more than one (1) parish, the chief officers of the parishes involved may select one (1) of themselves to represent the parishes as the ad hoc member. In case of the failure of the chief officers to agree upon a representative, each of the chief officers who wishes to be the ad hoc member shall be permitted to participate in the proceeding, but the involved parishes shall together still have only one (1) vote.

F. No member of the Commission shall participate, in any proceeding, hearing, application, request for ruling or other official determination, judicial or otherwise, in which any of the following has a financial interest: the member himself; his spouse; his child; his partner; any organization in which he is then serving or has, within two years prior to his appointment to the Commission, served in the capacity of officer, director, trustee, partner, employer or employee; any organization within which he is negotiating for or has any arrangement or understanding concerning prospective partnership or employment.

G. Members of the Commission shall be compensated \$50.00 per diem for each and every day spent attending to business of the Commission. In addition, all members shall be reimbursed for all reasonable and necessary expenses incurred in the performance of their duties.

H. The Coastal Resources Commission shall engage such independent staff as may be necessary to carry out its powers and responsibilities. The Attorney General shall be the Attorney for the Commission.

I. The Coastal Resources Commission shall have the following powers:

1. Promulgate, in accordance with the Louisiana Administrative Procedure Act, rules, regulations, criteria, and standards necessary to properly manage the coastal zone. The ¹ (planning agency), the Office of Coastal Zone Management, the ¹, (research agency), local governing authorities, and interested parties may recommend rules, regulations, criteria, and standards.

2. Establish goals, priorities and objectives for the Louisiana Coastal Zone Program.

3. Hear and rule on permit applications upon referral or appeal from the Office of Coastal Zone Management.

4. Review and approve and submit to the Legislature an annual budget for the Coastal Resources Commission, ¹ (research agency), the Office of Coastal Zone Management, and ¹ (planning agency) to ensure that financial allocations are made in accordance with the goals, priorities and objectives of the Louisiana Coastal Zone Program.

5. Conduct hearings in accordance with the Louisiana Administrative Procedure Act. The Coastal Resources Commission shall have the authority to delegate the power to preside at hearings to one or more of its members. All hearings shall be open to the public and reasonable public notices shall be given of all hearings.

6. Update and revise rules, regulations, criteria and standards on a continuous basis when appropriate to comply with federal statutes, rules, regulations, and guidelines.

7. Prepare and submit to the Legislature, the Governor, and the public an annual report describing and evaluating the Louisiana Coastal Zone Program.

8. Accept, receive, and administer grants, contributions and appropriations and to allocate them to the three functional programs in accordance with the goals, priorities, and objectives of the Louisiana Coastal Zone Program.

9. Enter into and execute contracts.

10. Sue and be sued in any court of competent jurisdiction. Venue, for suits against the Commission, shall be in the parish of East Baton Rouge or in the Parish where the proposed use would take place.

11. Periodically hold meetings as may be necessary to conduct business. All meetings shall be open to the public and reasonable public notice shall be given of all meetings.

12. Acquire or recommend the acquisition of full title, servitudes, easements or other rights in relation to real property by donation, purchase, exchange, or lease and to utilize such property, in conjunction with other agencies, as beaches, sanctuaries, wildlife refuges, game management areas, or other facilities as may be necessary to achieve the purposes of this act. This power shall not be construed to supersede the land management functions of existing state agencies.

13. Acquire or recommend the acquisition of full title, servitudes, easements or other rights in relation to real property by donation, purchase, exchange, lease or eminent domain for use as coastal and marine sanctuaries.

14. Do all things necessary to carry out the purposes of this act.

J. No rules, regulations, criteria, standards, ordinances or resolutions intended to have the effect of law with respect to significant uses of the coastal zone shall become effective unless approved by the Coastal Resources Commission.

Section 5: Management: The Office of Coastal Zone Management

A. There is hereby created the Office of Coastal Zone Management.

1. The Office of Coastal Zone Management shall be assigned to the _____¹ and the _____ shall be responsible for the administrative operations of the Office of Coastal Zone Management.

2. The Office of Coastal Zone Management shall be under the supervision and control of an administrator employed in accordance with the Louisiana Civil Service laws by the director of the agency to which the Office of Coastal Zone Management is assigned with the advice and consent of the Coastal Resources Commission. The administrator shall have exceptional professional qualifications, expertise, and experience with regard to the management of natural resources. The administrator shall be responsible for providing such additional staffing as may be necessary to carry out the provisions of this Act, in accordance with rules and procedures of the agency to which the Office of Coastal Zone Management is assigned.

B. The Office of Coastal Zone Management shall have the following powers:

1. Receive, evaluate, and pass on applications for permits for significant uses as defined by §2(H)..

2. Require modifications in proposed uses as conditions to the granting of permits. This shall include the power to require that appropriate steps be taken to mitigate or minimize the adverse impacts of the use as a condition to the granting of the permit. This shall also include the power to require assurances, including security, that the applicant will in fact take the agreed upon steps to minimize adverse impacts.

3. Conduct or cause to be conducted such investigations and studies as may be necessary to consider permit applications and the cumulative effects thereof and to carry out the purposes and provisions of this act and rules, regulations, criteria, and standards promulgated hereunder.

4. Systematically monitor and conduct surveillance of significant uses which have been permitted to ensure that conditions of permits are being fully complied with.

5. Conduct short-term planning and research necessary to make management decisions on a day-to-day basis.

6. Recommend appropriate enforcement measures for violations of the criminal provisions of this act.

7. Seek civil relief, as provided by Section 15 of this Act, in order to carry out the purposes and provisions of this Act and rules, regulations, criteria, and standards promulgated hereunder.

8. Enter into and execute contracts with any person necessary to implement the purposes and provisions of this act.

9. Coordinate closely with the _____¹ (the planning agency), _____¹ (the research agency), the Coastal Resources Commission and all local, state, regional, or federal agencies with respect to the management of the coastal zone.

10. Do all things necessary to carry out the purposes of this Act.

Section 6: Planning; _____¹

A. Long-range coastal zone planning shall be the responsibility of the _____¹. In undertaking this planning function the _____¹ shall:

1. Recommend long-range coastal zone research and coastal zone management goals, objectives, and priorities to the Coastal Resources Commission, the Legislature, the Governor, the Office of Coastal Zone Management and other state, local, and federal agencies.

2. Synthesize research and other data into a form usable by the Office of Coastal Zone Management.

3. Integrate long-range coastal zone research and management goals, objectives, and priorities with other goals, objectives and priorities of the State of Louisiana.

4. Coordinate with local and regional planning agencies and seek their active participation in coastal zone planning.

5. Create local government advisory committees composed of representatives of regional planning commissions and/or local governments in order to receive, on a continuing basis, advice as to the viewpoints of local governments with respect to coastal zone planning.

6. Promote, to the extent practicable, full public participation in coastal zone planning.

7. Review, on an ongoing basis, the rules, regulations, criteria or standards of the Coastal Resources Commission and recommend changes when appropriate to conform with federal statutes, rules, regulations or guidelines.

8. Develop, in conjunction with the Office of Coastal Zone Management and recommend for adoption by the Coastal Resources Commission, a list of all permissible uses under this statute, a continuing inventory of the resources and land and water uses of the coastal zone, and a set of broad guidelines on priority uses for specific geographic areas, all consistent with the provisions of this act.

Section 7: Research; _____¹

Long-range coastal zone research shall be the primary responsibility of the _____¹ with the assistance of other research organizations. It shall be the responsibility of the _____¹ to conduct necessary long-term research regarding proper procedures, techniques and scientific capabilities necessary for the management of coastal and marine resources. Insofar as possible this research shall be responsive to the needs, goals, and objectives of the Louisiana Coastal Zone Program as determined by the Coastal Resources Commission.

Section 8. Cooperation of Other State Agencies

It shall be the responsibility of every state agency, local governing authority, and political subdivision of the State of Louisiana to cooperate fully and coordinate closely with the Office of Coastal Zone Management the _____¹ (the planning agency), _____¹ (the research agency), and the Coastal Resources Commission in achieving the objectives of the Louisiana Coastal Zone Program.

PART C: PERMIT PROGRAM AND PROCEDURES

Section 9: Permits Required for Significant Uses: Procedures for Applying; Evaluations: Authorization for Denial

A. No person shall make a significant use as defined by §2 (H) without first obtaining a permit from the Office of

Coastal Zone Management or the Coastal Resources Commission.

B. Any person who proposes to make a significant use shall present an application for a permit to the Administrator. The Coastal Resources Commission shall determine by means of administrative regulation the forms and information necessary for a proper application, and may require applicants to furnish reasonable filing fees and reimbursement of expenses.

C. Upon the receipt of an application, the administrator shall make a determination as to whether the application proposes to make a significant use.

D. If he determines that the application would not involve a significant use, he shall so certify.

E. If he determines that the application would involve a significant use, he shall comply with §11 and conduct a thorough evaluation of the proposed use, fully considering all of the criteria enumerated by §10.

F. After the evaluations have been conducted, and after compliance with §11, the administrator shall grant or deny the permit or impose conditions on the granting of the permit or refer the matter to the Coastal Resources Commission.

G. He may deny the permit or impose conditions upon the granting of the permit if he makes a finding that the proposed use or the proposed use without conditions would be inconsistent with the applicable criteria enumerated by §10 and incompatible as defined by §2(E).

H. The administrator shall submit written reasons for his decision with respect to each permit application.

I. If the administrator makes a finding that the application is one which involves a significant controversy or which is of significant public interest, he shall defer a decision on the application and refer the matter to the Coastal Resources Commission. Receipt of comments from the public as a result of the disseminations required by §11 shall be evidence of a significant controversy or significant public interest. If the administrator refers a matter to the Coastal Resources Commission he shall submit to the Coastal Resources Commission his technical recommendations with respect to the application. The Coastal Resources Commission shall hold a public hearing on the application in accordance with the Louisiana Administrative Procedure Act. The Coastal Resources Commission shall make a decision on the application within 15 days following the hearing.

Section 10. Criteria for Decision-Making

A. In evaluating applications for permits for significant uses as defined by §2(H) the Office of Coastal Zone Management and the Coastal Resources Commission shall fully consider all pertinent environmental, social, legal, economic and other criteria and the findings, declarations and purposes expressed by §1 of this Act.

B. The following shall be discouraged:

1. Uses which would cause adverse effects on living resources productivity, adverse ecological effects, and other long-range adverse effects.

2. Heavy industrial or commercial development and urbanization which would cause the permanent alteration of the natural characteristics of estuarine systems or which would take place in substantially undisturbed wetland areas.

3. Uses which would precipitate or induce secondary impacts and developments which would result in inconsistency with the criteria enumerated in this section or incompatible uses as defined by §2(E).

4. Uses which would require additional flood protection works to be constructed in undisturbed or substantially undisturbed wetlands.

5. Uses which would impose restrictions on public access or use of recreational coastal resources, unless the public access or recreational use would be detrimental to the environment.

6. Uses which would unduly burden sewer and solid waste disposal facilities.

7. Uses which would take place on soils intrinsically ill-suited to adequately support those uses.

9. Uses in areas where there are habitats for rare or endangered species of wildlife, or unique or irreplaceable historical or archeological sites, or aesthetic amenities particularly unique to Louisiana's coastal zone.

C. The cumulative impacts of uses and proposed uses on the estuarine systems shall be thoroughly and specially considered. When the point is reached such that additional significant uses will alter natural capacities of estuarine systems, then additional significant uses shall be prohibited.

D. Economic effects, including the number of jobs created and the income which would be generated by the wages and salaries of those jobs, the amount of tax revenues potentially accruing to state and local governments, and the need for increased governmental services to support the developments shall be fully considered.

E. In addition to the statutory criteria enumerated in subsections (A), (B), (C) and (D) of this section, the Office of Coastal Zone Management and the Coastal Resources Commission shall fully consider all rules, regulations, criteria, and standards promulgated by the Coastal Resources Commission.

Section 11. Public Dissemination

A. After the Administrator receives a permit application and if he determines that it would involve a significant use, he shall disseminate notices of the application to all persons who have made written requests to be notified of such applications. The Administrator shall also cause the notices to be published in all newspapers where there is reason to believe there would be an interest in the proposed use. Notices shall contain the following information:

1. A description of the proposed use.
2. A synopsis of the probable beneficial effects of the proposed use.
3. A synopsis of probable adverse effects of the proposed use.

B. At the discretion of the Administrator, these notices may be contained and disseminated by means of weekly or bi-weekly bulletins.

C. The Administrator shall invite and encourage public comment on the proposed uses and shall take such comment as is consistent with the purposes of this act into consideration when making his determinations.

D. The requirements of this Section may be waived in emergency situations, as defined by regulations of the Coastal Resources Commission. Provided, however, where an emergency action is taken by the Administrator, notice must be immediately given to the members of the Coastal Resources Commission and immediately disseminated to the public.

E. The Administrator shall disseminate immediately to the public notices of action taken on permit applications.

PART D: REVIEW

Section 12. Administrative Appeals

A. Upon the petition of the applicant or 25 persons, the Coastal Resources Commission shall review the decision of the Office of Coastal Zone Management with respect to the granting or denial of a permit. Provided, however, that petitions for administrative appeals shall be filed within 10 days following public notice of final determinations by the Office of Coastal Zone Management. Provided further that the Coastal Resources Commission shall hear the matter and render a decision within 30 days following the day of receipt of the petition for review.

B. Any person shall have the right to submit a written statement with respect to any application. The Commission shall take such statements into consideration when making its determinations.

C. Appellate hearings shall be conducted in accordance with the Louisiana Administrative Procedure Act.

D. With regard to administrative appeals, the Administrator shall not be entitled to vote.

Section 13. Judicial Review

Any person who exercises his right of administrative appeal as provided by Section 12 shall be entitled to judicial review in accordance with the Louisiana Administrative Procedure Act.

PART E: ENFORCEMENT AND PENALTIES

Section 14. Criminal Penalties

A. Any person who intentionally makes a significant use as defined by Section 2 (H) without obtaining a permit from the Office of Coastal Zone Management or any person who intentionally violates the terms or conditions of a permit issued under the provisions of this act shall be guilty of a violation of this Act. Any person who violates this Act shall be subject to a fine of not more than \$10,000 for each and every day in which the violation occurs or imprisonment for not more than 6 months or both.

B. The Attorney General shall have the authority to directly prosecute persons accused of violations of sub-section A without the necessity for prior referral to any District Attorney.

Section 15. Civil Penalties

A. The Administrator shall have the authority to seek injunctive relief, including temporary restraining orders and preliminary injunctions, against any person he deems to be in violation of this Act or rules, regulations, criteria, or standards promulgated hereunder.

B. The Administrator shall have the authority to issue cease and desist orders against any person or agency he deems to be in violation of this act or rules, regulations, criteria, or standards promulgated hereunder. Provided, however, that cease and desist orders shall not remain in effect for a longer period of time than ten (10) days.

C. The Administrator shall have the authority to revoke any permits issued for significant uses for good cause. Upon the revocation of a permit, the user shall have the right to apply to the Coastal Resources Commission for a review of the Administrator's decision pursuant to Section 12.

D. The Administrator shall have the authority to seek civil damages. Monies collected through damage suits shall be utilized to meet the costs of restoration of any affected area to its condition prior to such violations, insofar as practicable.

Section 16. Complaints

A. Any person shall have the right to file a complaint with the Administrator alleging that a significant use has occurred in violation of this Act or that a violation of the conditions of a permit has occurred. Whenever from the complaint it appears to the Administrator that there is reasonable cause to believe that a violation has occurred, or is occurring, the Administrator may take action himself, or he may refer the matter to the Coastal Resources Commission, along with his technical findings. If the Coastal Resources Commission determines that there is reasonable cause to believe that such a violation has occurred or is occurring, it shall take appropriate action authorized by this Act.

B. If after the filing of the complaint with the Administrator, thirty (30) days have elapsed and the Administrator has neither taken direct action, referred the matter to the Coastal Resources Commission, nor adequately explained in writing to the satisfaction of the complainant his reasons for not acting on the complaint, the complainant shall have the right to file the complaint directly with the Coastal Resources Commission. The Coastal Resources Commission may take appropriate action as authorized by this Act.

PART F: MISCELLANEOUS

Section 17. Applicability of Act

This act shall apply to:

A. All significant uses, where the application for the permits are submitted to the Administrator after _____*;
and

B. All significant uses, proposed to occur before _____* where the user has not yet begun work;
and

C. All significant uses occurring prior to _____* provided it is practicable to reconsider any or all aspects of the use to conform to this Act.

D. All significant uses occurring after _____* where the user has not applied for a permit.

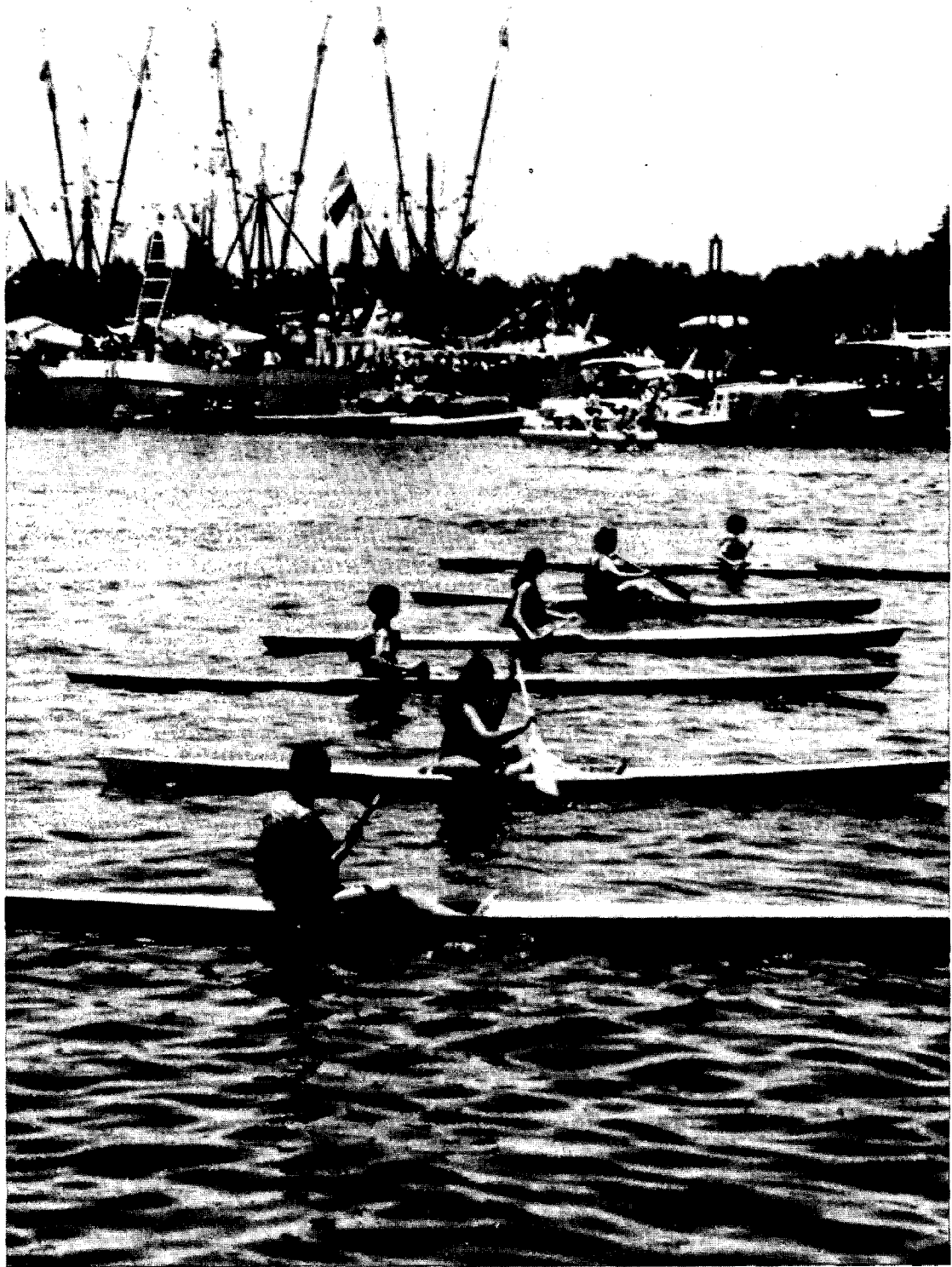
With respect to any significant use described in subsection C, or any significant use where it is not practicable to reconsider any or all aspects of the use, further work on the use shall be undertaken to minimize or mitigate the impact of the use on estuarine systems.

Section 18. Severability

If any provision of this Act or the application thereof is held invalid, such invalidation shall not affect other provisions or applications of this Act which can be given effect without the invalid provisions or applications and to this end all of the provisions of this Act are hereby declared severable.

*Six months after the effective date of the act.

¹The Governor and the Legislature will determine which agencies shall be responsible for the implementation of this statute. Recommended agency assignments, as well as alternative assignments, are fully explored at the beginning of this chapter. The Commission recommends that the Office of Coastal Zone Management be attached to the Louisiana Wild Life and Fisheries Commission, that the Office of State Planning be responsible for coastal zone planning, and the Louisiana Sea Grant Program be responsible for coastal zone research.





CHAPTER SIX
Special Programs for Louisiana's Coastal Zone

SECTION ONE
Louisiana's Marine Related Industries

A Report of the
Ocean Engineering
and
Development Committee

Although Louisiana's current industrial capacity in fishing, minerals and support industries is extensive and invaluable, new ideas are destined to increase productivity, help conserve natural resources, and effect optimum benefits for the people of Louisiana.

The extent of the fishing industry's impact on the state's economy is evident in 1970 data. (More recent data will be published by the Louisiana Wild Life and Fisheries Commission this year.) The 1970 commercial fish catch, more than 1.1 billion pounds, had a dockside value of \$62.5 million.(1) This catch was not unusual, for Louisiana fisheries often report production exceeding one billion pounds in a year.(2)

In terms of volume of fish landed, Louisiana leads all other states. The Gulf of Mexico produces one third of the nation's seafood supply. Of this third, more fish are produced in Louisiana than in the four other Gulf states combined. The state is second only to Maryland in oyster production, supplying 20 per cent of the nation's total market.(3) Louisiana is the only state in which oysters are harvested year-round.

Though not a fishing industry, fur trapping should be mentioned because of its contribution to the economy and its value to the coastal zone, where about 95 per cent of the commercial fishing activity in Louisiana occurs. Almost 40 per cent of the nation's wild fur pelts come from Louisiana.

By comparison with existing production, untapped potentials for fish production are equally impressive. The coastal zone is vast enough to support and nurture increased yields. It is larger than the combined areas of

*This section was prepared by a special statutory committee on ocean engineering and development added to the Commission by Act 166 of 1972. Members included Fred W. Hartdegen, Chairman; Drew Michel and Merrill True.

Connecticut, Delaware and Rhode Island. Of its approximately 7.1 million acres, about 3.7 million are marsh or swamp, and 3.4 million are associated surface water area, which, in combination, support vast fisheries and wildlife resources.

Further, mariculture, or "farming" the sea, has great potential in Louisiana and its offshore waters. For years, marine artificial reefs have existed in the form of offshore oil platforms which abound with fish. But when the wells run dry and the platforms are removed, the fish leave as well. Not dismantling the platforms would save money for the company and keep fish life in the area. Pompano and other species might be raised in controlled cages on the artificial reefs. A significant problem arises if the platforms are transferred to governmental or commercial fisheries groups since insurance and maintenance costs are very high and may be prohibitive.

New technologies help in the study and location of fisheries resources. For determining damage to oyster beds and checking reproduction in them, experiments have been conducted with underwater television. Possibly, such a technique would be useful in clear water areas of the Gulf in locating schools of fish. Night flights have been conducted, also on an experimental basis, off the Louisiana coast to determine the feasibility of locating menhaden schools this way.

Evidence for the exploits of Louisiana's fishing industry is impressive; however, an account of the minerals industry discloses some astounding facts also. The value of Louisiana's 1972 mineral production exceeded \$5.6 billion and Louisiana retained second place nationally in this category.(4) Of this total, more than \$5 billion resulted from oil and gas production.(5) With a natural gas yield of 8.4 trillion cubic feet in 1972, Louisiana replaced Texas as the nation's leading gas producing state.(6) Production of 779 million barrels of crude oil kept Louisiana in the nation's No. 2 spot in that category.(7)

Louisiana's 1972 sulfur yield was more than 3.3 million long tons.(8) In a recent year, sulfur production was valued at \$140 million.(9)

More than 13.9 million short tons of salt (rock and in solution) were produced during 1972 in the state.(10) Responsible for 30 per cent of the nation's salt production, which was valued in excess of \$67 million, Louisiana was the No. 1 state in this category.(11) Availability of raw materials, sulfur among them, is a primary reason for the great surge of petro-chemical activity in the state. (This topic is addressed in Chapter One under the heading "Refining and Manufacturing.")

Oil, gas, sulfur and salt can be traced to the presence of massive salt domes. "Islands" from which salt is mined are, in fact, parts of salt domes poking up through the marsh. The domes cause geological faults, or earth crevices, in which oil, gas and sulfur may be found. Endowed with an abundance of these domes, Louisiana is in possession of some of the world's great salt mines and sulfur mines. The giant domes have helped Louisiana become the nation's No. 1 offshore oil and gas producing state. With more than 14,000 wells drilled in offshore Louisiana, the state has about 60 times as many offshore producing wells as Texas.(12)

Two new developments moving toward reality and a role in the industrial drama in offshore Louisiana are the superport and surface effect vehicles.

The superport seems certain to become an economic catalyst. Abundant natural resources and experience garnered by industry in utilizing these resources undoubtedly will be factors in decisions affecting the location of the superport off Louisiana's shores.

Surface effect vehicles work on the air-cushion principle. Present large models weigh about 200 tons and have a maximum speed of nearly 80 miles per hour (71 knots). Some oil-field experts believe these vehicles will replace boats and helicopters in many offshore fields. The nation's only manufacturer for such vehicles opened operations in Louisiana recently.(13) (Surface effect vehicles are discussed in Chapter Six, Section Four.)

Offshore production, a complex operation relying upon skills and materials from other sources, spawned a network of support industries. Pioneers in activity off the shores of Louisiana, these support industries are world leaders in offshore work today.

Four basic support industries related to Louisiana's offshore industry are drilling, construction, transportation and diving.

Drilling rigs of today are a far cry from rigs of 10 to 15 years ago. Today's rigs are veritable floating palaces that can drill in water depths of several thousand feet. They cost from \$17 million to \$30 million each.

The world's largest offshore drilling contractor is from Louisiana.(14) This firm, one of the pioneers of the ocean drilling industry, continues to lead with new techniques and has drilling rigs in many offshore areas of the world.

Superlatives apply also to marine construction in Louisiana, where the world's two largest offshore construction firms are located.(15) Both build production platforms, semisubmersible drilling rigs and support ships. They also fabricate pipe. The firms employ thousands, who they say are among the highest-paid marine employees in the world.

Louisiana also has the world's three largest offshore crewboat builders.(16) They began by servicing rigs in the Gulf but their operations soon encompassed a worldwide market. The technology they developed in designing a fast, reliable crewboat for conditions in the Gulf of Mexico soon was recognized as unique. The U.S. Navy and several foreign navies, recognizing the importance of the design, have awarded numerous contracts to these firms to build patrol boats.

As offshore exploration developed outside the United States, demand for these boats grew to the extent that crewboats built in Louisiana assist in offshore drilling operations throughout the world.

In the transportation field, Louisiana's status has been enhanced by these boat builders, who realized early that problems related to servicing the offshore industry would become enormous. Perhaps the best measure of their success is the fact that the world's two largest offshore boat operators are claimed by Louisiana.(17) Both companies originated in South Louisiana only a few years ago. Today, they are publicly held corporations with hundreds of boats operating on a worldwide basis.

In addition to boats, helicopters play a major role in offshore transportation, principally for quick trips. They ferry service crews on short notice and convey highly important data, such as electric logs or core samples. Scheduled crew changes quite often are carried out by helicopter shuttles. Use of helicopters by the Louisiana offshore industry is the most extensive in the nation.

As water-based industrial efforts increased, added importance was placed upon the diving industry. An integral part of offshore operations, diving is truly an oceanographic industry and a pioneer in related research. Without it, offshore operations would be virtually impossible because diving is so much a part of offshore activity.

Diving capabilities have been advanced to the point that drilling operation can be supported in more than 600 feet of water. Newer saturation diving systems can sustain divers in more than 1,000 feet of water.

Diving companies continue to carry out research and development to extend their operations into deeper and rougher water. The Gulf of Mexico off Louisiana has been the training ground and proving ground for the largest and most active diving companies in the world. Of the world's six largest, five use Louisiana as home base. (18)

Although the fisheries and mineral industries of Louisiana, along with the four support industries which serve them, have provided substantial benefits to the state, the Commission recognizes three major problems in Louisiana's marine and ocean-oriented development program.

First, Louisiana's citizens are not as aware of the oceanographic and marine-oriented activities of the state as they should be. This constitutes a substantial impairment to progress within our own boundaries. Although Louisianans tend to benefit directly from coastal and marine activities through employment or recreation, most are unaware of the scope of their assets in Louisiana and its economic value to the state and the nation. This has some serious reverberations within Louisiana. Because of inadequate marine-oriented training, Louisianans are forfeiting local jobs to out-of-staters. Usually when Louisianans get these jobs, they have received their training at schools and universities outside the state.

Beyond making citizens more aware of job potentials within the state, it is critical that our citizens appreciate their state more than they have. Pride in our assets and achievements should be a part of every Louisianan. Since our ocean-related and marine-oriented activities are among our greatest assets, these activities should be common knowledge among our citizens.

Second, many of the dollars generated as a result of economic activities in Louisiana leave the state. This deprives other sectors of our economy from potential benefits. For example, because most crewmen who work on the platforms off Louisiana's shore do not live here, the money they earn is spent elsewhere. Additionally, and perhaps more significantly, wellhead equipment, instruments, drilling and undersea apparatus used in mineral production in Louisiana come almost exclusively from outside the state. Hence, substantial portions of money paid for construction and operations within Louisiana gravitate to other areas of the country, where much of this special equipment is manufactured.

Third, other states get more recognition than Louisiana for their ocean-oriented activities. In Rhode Island and Oregon, for example, substantial efforts are under way by state government and universities to make their states pre-eminent in oceanography and ocean-related activities. Louisiana has achieved more than either of

those states but has lacked sufficient national publicity. Consequently, Louisiana's economic position could be harmed. Industries, workers, or travelers, when unaware of the assets of Louisiana's marine-oriented activities, may tend to overlook Louisiana in favor of another location. Further, a better image for Louisiana's marine-oriented activities nationwide could pave the way for other benefits. Federal funding programs, national associations and other groups may pay Louisiana more attention if efforts at publicizing the state's assets are increased.

State government and industry should begin a program of cooperation to overcome these weaknesses as soon as possible. With the great resources available within Louisiana, every effort should be made to maximize their benefits to the state.

The Commission recommends that an entity be established within state government to enhance Louisiana's role in marine and ocean industries. This entity could be either a commission or board, a special section within the Department of Commerce and Industry or a responsibility of the executive office of the governor. The entity could receive private as well as public funds. It should be capable of operating effectively within the executive branch of government and should have close ties to industry. The entity's responsibilities would include:

1. Promoting marine and ocean-oriented activities within the state;
2. Promoting Louisiana as a leader in marine and ocean-oriented activities in the nation;
3. Assessing Louisiana's manpower needs, industrial potential and educational facilities and programs in marine and ocean-oriented activities;
4. Acting as the public relations vehicle of the state insofar as marine and ocean-oriented activities are concerned;
5. Assisting in obtaining federal funds for marine and ocean oriented activities.

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CHAPTER SIX
Special Programs for Louisiana's Coastal Zone

SECTION TWO
Coastal Zone
Research and Education

The great area and economic importance of Louisiana's coastal zone make effective management of its lands, waters and resources a vital concern of the state and nation. Effective management depends on a variety of scientific, technologic, legal, political-institutional and socio-economic factors or capabilities. Among these are: (a) fundamental understanding of complex coastal zone ecosystems, (b) valid techniques for predicting economic and environmental impacts, singly and in concert, of a diversity of activities and developments proposed by man, and (c) efficient institutional arrangements, regulations and enforcement provisions. None of these capabilities or goals can be achieved without knowledge, obtained through research, and sufficient numbers of well-trained personnel to implement and conduct needed activities.

The Commission believes that the present level of knowledge concerning Louisiana's coastal zone and the number of trained personnel actively engaged in well-organized or focused marine and coastal programs are totally inadequate to satisfy public needs. Problems or issues associated with these needs and remedial actions are recommended.

I. Research

A. University-state agency cooperation

An acute and immediate need exists for developing mechanisms that will encourage and facilitate cooperative university-state agency research on coastal and marine problems. State agencies are, of necessity, primarily concerned with immediate or operational problems. They usually have the capacity to identify high priority research needs which incorporate views of local organizations and citizens, obtain pertinent field data and implement or enforce changes in practices dictated by research program results. But often they are unable to assign sufficient funds or personnel to the analysis of assembled data and keep abreast of scientific and technologic developments. Conversely, a university does have the capacity to take a longer-range and more comprehensive look at coastal and marine problems, conduct thorough analyses of available data and maintain awareness of scientific and technologic advances.

However, most universities regard teaching as their primary mission and discipline-based research along departmental lines as an ancillary function. A fundamental challenge that has not been faced by most universities is the development of effective techniques for administering sorely needed interdisciplinary studies relevant to local or regional needs and of direct use to selected state agencies.

Effective university-state agency cooperation will require institutional and attitudinal changes on both sides. University administrators and faculty must adopt a more positive attitude toward applied or mission-oriented research and public service programs. Concurrently, the reward structure within the university must be changed to provide recognition for accomplishments in these fields. This may be possible only through the creation of special divisions or organizational units wherein the criteria employed in assessing accomplishments differ from those utilized in the instructional and discipline-based departments.

University attempts to become more responsive to a broader range of public needs can succeed only if state agency personnel are truly receptive to cooperative endeavors. These individuals must accept the sincerity of cooperative overtures by the university and overcome the all-too-common attitude that all university faculties are overeducated, impractical and unresponsive scientists incapable of efficient program management.

On the other hand, university personnel must accept the fact that all state agency employees are not second-rate scientists working on mundane problems unworthy of intense scientific investigation. Such attitudes can be overcome only through establishment of working-level programs and relationships that satisfy both organizational and individual needs.

Careful consideration must be given to the staffing of cooperative efforts to maximize the probability of success--both from a technical standpoint and one of establishing mutual trust between the university and the agency. Present institutional arrangements, contractual procedures and state civil service regulations work against the development of truly cooperative, team efforts involving state agency and university personnel. Mechanisms to circumvent or eliminate these obstacles should be devised and employed extensively. In addition, the temporary transfer of personnel between universities and state agencies should be encouraged. This must be accomplished in a manner not detrimental to the individual in terms of salary, promotional opportunities, fringe benefits or retirement options.

The Commission strongly believes that effective conduct of marine and coastal research in Louisiana can be achieved only through top-to-bottom cooperation of state agency and university personnel in planning and implementing programs and applying research results. State agency contracts with university faculty members, either on an institutional or private basis, cannot be thought of as an acceptable substitute for needed state agency-university cooperation in marine and coastal research.

B. Sea Grant Program Support

The National Sea Grant College and Program Act was signed into law in 1966. The legislation is designed to bring the expertise of academic institutions, research institutes and laboratories to bear on practical problems relating to the management and accelerated development of the nation's marine and coastal resources. The program is administered by the National Oceanic and Atmospheric Administration of the U.S. Department of Commerce. It has increased in funding from \$5 million in fiscal 1968 to \$19.5 million in fiscal 1973. Although this increase is significant in these tight-budget days and reflects wholehearted Congressional support, it has not permitted establishing viable Sea Grant programs in each of the 30 coastal and Great Lakes states--a major goal of the program. Consequently, considerable competition exists among universities in the various states to obtain Sea Grant funds.

Funding support is provided in three categories: project grants, coherent area grants and institutional grants. Universities receiving institutional grants have high priority for obtaining available funds. Fifteen institutions, including LSU, are in this category. In addition, six of the fifteen institutions have been designated Sea Grant Colleges and enjoy the highest possible priority for obtaining federal monies. In 1971, Texas A&M University, Oregon State University, University of Washington and the University of Rhode Island were designated Sea Grant Colleges. In 1972, the University of Wisconsin and the University of Hawaii were so designated.

Achieving this designation requires strong university and state commitment to the program concepts, superior performance at the institutional level for three years and effective conduct of regionally significant research, education and advisory service efforts in the marine field. Funds are provided on an annual basis, pursuant to the National Oceanic and Atmospheric Administration review of the program and proposed work for the following year. If the proposed program is approved, federal funds are provided for two thirds of the total cost, and the state must provide the remaining one third.

In Louisiana, both Louisiana State University and Nicholls State University have participated in the program since its formal initiation in 1968. NSU received project grant support in 1968, '69 and '70. Since 1971, continuing projects have been conducted by NSU and administered through the LSU program. LSU received coherent area grant support in 1968, '69 and '70. In 1971, LSU achieved institutional grant status. Under the LSU program, projects have also been conducted by researchers at the University of Southwestern Louisiana and Northwestern State University. Thus, although the Louisiana Sea Grant activities are administered by LSU, it is a statewide program and the expertise of any university in the state can be focused on marine and coastal problems through this mechanism.

A basic objective of the Louisiana Sea Grant program is to play a major role in providing the knowledge, methodologies and trained manpower required to assure wise management and development of the state's marine and coastal resources. This will require a much more comprehensive understanding of natural systems and man-environment relations than we possess. It is recognized also that scientific truths are but one aspect of a complex association of social, economic and legal factors that demand exploration if practical solutions to problems are to be obtained. Although the universities cannot--and should not--make management decisions regarding Louisiana's coastal zone or marine resources, they can--and should--document needs and provide capabilities that will encourage appropriate state agencies to implement and enforce programs essential for the optimum development of these areas and resources.

The Commission believes that the National Sea Grant Program provides an opportune mechanism to aid the universities in this role and that every effort should be made to maximize Louisiana's role in this program.

A major obstacle to desired participation and growth has been the lack of "hard cash" state monies to meet the program's one-third matching requirement. The requirement has been met primarily by "in-kind" contributions such as percentages of investigators' salaries and overhead writeoffs. This does not provide needed leverage to broaden scientific and technologic competence and compete successfully for Sea Grant funds with institutions in other states with well-established, broadly based marine research and education programs.

By the end of 1973, approximately \$3 million in federal monies will have been committed to the Louisiana Sea Grant program since its inception in 1968. Achieving annual funding at the million-dollar level and Sea Grant College status for LSU depends primarily upon (1) outstanding programs performance and (2) demonstration of a strong university and state commitment to Sea Grant activities. Hard cash matching through

a Sea Grant line item appropriation in a university or state agency budget is the best way to demonstrate this commitment and assure program vitality.

The Commission strongly recommends that a hard cash, line item, annual appropriation of \$500,000 be established for support of the Louisiana Sea Grant program. (In 1971 and 1973, the legislature passed special appropriations of \$125,000 and \$200,000, respectively, for Sea Grant matching funds, but there is no guarantee of continuing support.)

C. The Role of Local Government and Special Interests

Effective design and conduct of research programs aimed at the practical solution of coastal zone problems dictates active and concerned involvement of local government and special interest groups. Such involvement is essential if truly significant research problems are to be identified, valid priorities established for the study of these problems and research products obtained that will be useful in the implementation of practical solutions.

The Commission recommends strengthening of all existing communication links concerning research needs and activities amongst state agencies, universities, local government and industrial-commercial elements. As these links are presently inadequate, it is further recommended that advisory bodies and other mechanisms be employed to assure that local government, industry and others have an appropriate influence on the design and conduct of marine-related research in Louisiana. The Commission specifically recommends that Sea Grant establish an advisory council, with representation from state government, local government, environmental groups, industry, universities and other special interest groups to review and guide the Louisiana Sea Grant Program. It is urged also that industrial organizations and others confronted with marine-related problems make every effort to utilize expertise available in Louisiana's public and private institutions and firms in the solution of these problems. Universities should not play a passive role in this situation but should continually monitor the developing needs of industry for such services and develop appropriate programs and staff to service these needs.

D. Research Priorities, Responses and Overview

Although university-state agency cooperation, with appropriate input from local government and special interests, can contribute to the formulation and conduct of more focused and relevant research activities, the resulting program may still be biased toward mission-oriented needs of specific agencies and research interests of university faculties. Therefore, a decided need exists for governmental overview and direction that will assure development and conduct of a coordinated, high-priority, well-balanced coastal and marine research program for Louisiana.

The Commission recommends that a legislative or intergovernmental liaison group formally be assigned overview responsibility for state coastal and marine research activities. The group would also be cognizant of federal activities in this field and act to maximize federal support for needed state programs. Of special concern and importance is organizing state research capabilities to respond to opportunities afforded by the Coastal Zone Management Act of 1972. A single agency or division must have primary responsibility for these activities, and its selection should be made with full concurrence of the legislative, executive, state agency and university community.

Establishment of an overview body to assign specific agency roles and coordinate marine and coastal research programs should be explored carefully. As a minimum, membership of this body would include representatives from the Governor's Council on Environmental Quality, Joint Legislative Committee on Environmental Quality, Louisiana Wild Life and Fisheries Commission, State Planning Office, Louisiana Advisory Commission on Coastal and Marine Resources (or its successor), Register of State Lands, State Planning Office and the Louisiana Sea Grant Program.

II. Education *

A. Secondary Schools

Louisianans have taken the state's abundance of marine and coastal resources for granted. On the part of most, there is little appreciation of the state's unique and bountiful coastal zone and its importance in the history and economic well-being of Louisiana. This situation has contributed to the slow and inadequate development of marine and coastal research in Louisiana.

*See Appendix Three for additional treatment of this subject

The Commission believes that concerted efforts should be made to inform our citizens of their marine heritage and resource dependence. This is needed especially at the secondary school level. An immediate goal should be the inclusion of marine and coastal resource material as part of a formal course in the eighth-grade science curriculum of the public schools. Federal funds should also be sought to conduct marine science institutes for high school teachers.

B. Vocational Training

Although the coastal zone has managed over the years to provide economic and recreational outlets, the people of Louisiana are not benefiting fully from this wetland bonanza. Nor will they until adequately trained local manpower is available to tap its vast store of natural resources and develop their great potential for the future.

Insufficient marine-oriented, technologic research and education have brought about serious problems, which must be corrected if Louisiana is to be a leader in coastal zone development, an area upon which so much of the state's future depends. Among the most serious deficiencies is a shortage of locally trained, marine-oriented, technical workers, such as boat pilots, able-bodied seamen and diesel technicians. One disheartening consequence is that offshore construction firms need more than 5,000 welders, and the figure could double by 1980.

Dr. James P. Schweitzer of the Department of Marine Sciences at Louisiana State University in Baton Rouge sums up the most unfortunate aspect of the shortage this way: ". . .the highest paying jobs often are filled by out-of-state persons, owing to the scarcity of well trained local people."

Jobs are generated by offshore mineral production because satellite industries come into being to satisfy the manifold requirements and diverse nature of such activity. The satellite industries which relate most closely to offshore operations are construction, diving, drilling and transportation. The availability of jobs in these categories is indicated by the scope and intensity of the satellite operations and evidenced by the fact that in Louisiana are:

- the world's two largest offshore construction firms,(1)
- the world's three largest offshore crewboat builders,(2)
- five of the world's six largest diving companies,(3)
- the world's largest offshore drilling contractor,(4)
- the world's two largest offshore boat operators.(5)

Consequently, during the past several years, Louisiana has ranked high--usually third--among the states in total employment of individuals in marine-related industries. (Only California and New York consistently employ larger numbers of people in such activities.) Much of this employment is associated with the building and repair of ships and boats, water transportation and services supporting the offshore mineral industry. The obvious importance of marine and offshore technology has not been reflected in the state's vocational training activities. There are only one to two vocational training programs in the state aimed at producing marine technicians.

The Commission recommends that the labor needs of industry and the present marine technician labor force composition, i.e., in-state versus out-of-state, be determined by the appropriate state agency. It is believed that such an assessment will justify easy expansion of marine technician training programs. The South Terrebonne High School (Bourg) and the Young Memorial Vocational-Technical School (Morgan City) have developed programs that may well serve as models for activities in other areas. It should be emphasized, however, that priority would be better assigned to providing adequate support for existing programs than to the creation of new ones.

The Commission also recommends establishing an Offshore Marine Academy. The academy would be a cooperative endeavor by appropriate universities and technical schools to develop two- or four-year programs to train men in generalized capacities such as management, supervision, ocean engineering and seamanship.

C. Universities

In 1965, approximately 50 universities in the United States offered degrees in marine science, but not one was located in Louisiana. In 1966, a B.S. degree program in marine biology was established at Nicholls State University and in 1968, M.S. and Ph.D. programs in marine sciences were initiated, under Sea Grant auspices, at LSU-Baton Rouge. Marine-related courses are available at seven other universities in the state. There can be little doubt concerning the need for programs aimed at understanding Louisiana's complex coastal zone ecosystems and the effective management of associated resources. However, the availability of jobs for marine science graduates is contingent upon the establishment of such programs. The Commission does not recommend the creation of new degree programs until this job market is

well-defined and existing programs are funded adequately. Neither criterion is met at the present time. Special attention should be given the mix of university instruction available in marine biology, physical oceanography and marine socio-economic and legal fields.

The Commission believes that, although existing biological programs require additional facilities and equipment, primary emphasis should be given to the strengthening of nonbiological academic courses and programs. An exception to this statement is in the systems ecology and population dynamics fields, where additional program development is needed.

It is also strongly recommended that quality rather than quantity be stressed in all university marine science programs and that adequate support be provided existing programs to attain this goal. The Louisiana Coordinating Council on Higher Education, or its successor body, should monitor carefully ongoing and proposed programs to assure excellence and avoid needless duplication of effort.

Research on air-cushion, or surface-effect, vehicles is a field which lends itself to development at the university level. These vehicles may revolutionize transportation methods in many offshore areas by serving in lieu of boats and helicopters. Because these craft are now under construction in the state, it would be especially appropriate for Louisiana's universities to initiate a related research program. (Additional information concerning marine science programs and courses offered by Louisiana institutions is included in Appendix Three.)

III. Facilities

Unlike other Gulf Coast states, Louisiana has no marine science research and teaching facility. This is especially unfortunate when one considers the fact that marine and coastal resources are economically more important to Louisiana than to any other Gulf Coast state. The Louisiana Wild Life and Fisheries Commission conducts numerous biological and ecological studies utilizing the extensive marshlands of its refuge system as natural laboratories and its Marine Laboratory on Grand Terre for more controlled work.

However, the Marine Laboratory is not equipped to routinely handle students or university researchers. Most of the LSU Sea Grant field activities in the Barataria Bay area utilize a leased camp as a base of operations. Students participate in these research activities, but there are no classroom or laboratory facilities for formal or informal instruction. The University of Southwestern Louisiana maintains a similar facility at Fearman Lake. Nicholls State University recently

built a teaching research laboratory at Port Fourchon, but the facility is only partially equipped and can handle only a limited number of students.

The Commission believes there is an immediate need for a marine science teaching and research laboratory that would be available to all state university faculties and students. The laboratory should be accessible by automobile and boat and have adequate sleeping and cafeteria equipment to accommodate a minimum of 60 researchers and/or students. The board of directors of the laboratory should include representatives from each major user university and the operational responsibilities assigned a full-time, on-site staff. If this arrangement proves to be impractical, it is recommended that all major marine science research and teaching facilities established by state universities be located at a single site within the coastal zone to maximize savings and efficiencies that can accrue through joint utilization of support facilities, equipment and personnel.

Louisiana should also maintain a sea-environment laboratory placed at the disposal of universities and industry for study, experimentation and training in ocean engineering problems such as ship hull design, the effect of waves on offshore platforms, the suitability of materials used in hulls and offshore platforms and other problems related to the marine offshore industry.

A first rate marine science research and education program cannot be developed if Louisiana students, agencies and industries must continue to rely on out-of-state facilities for training and research services. Obtaining such facilities for the state is a high-priority activity.

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CHAPTER SIX
Special Programs for Louisiana's Coastal Zone

SECTION THREE
Recreation, Culture, and Tourism
In Louisiana's Coastal Zone

I. Overview

The marshland and swamp areas of the Louisiana coastal zone are so high in scenic, recreation, wildlife and fish values that Louisiana is called a "Sportmen's Paradise." Many believe the quantity and quality of recreation, culture and tourism outlets in the Louisiana coastal zone are unequaled elsewhere and constitute great potential for developing the coastal zone. Recreation, culture and tourism should be viewed together because they are interrelated. Tourism depends on recreational and cultural opportunities, and recreation depends, in part, on cultural opportunities. However in this section, recreation, culture and tourism are treated separately.

It is important to recognize that recreation, culture and tourism are human values which relate to attractions in the coastal zone and outside of it. Therefore, this section covers in rather abstract terms the value of recreation, culture and tourism. Particular emphasis is placed on those aspects of recreation, culture and tourism which are significant within the geographical boundaries of the coastal zone of Louisiana.

It is also important to note that there are at least four distinct types of land forms in the Louisiana coastal zone--water, marsh, swamp and highlands. Some recreational or tourist activities are found only on highlands, e.g., dry land hunting, picnicking and camping, but others require areas with more water. Unless specified otherwise, references apply to activities which are appropriate to the particular land forms.

II. RECREATION

A. Physical Problems

Recreation is a benefit which, if properly planned and managed, does not degrade coastal resources. However, recreational interests have at times competed with and adversely

affected other uses, such as commercial fisheries, development of navigation facilities, timber operations and mineral production.

Additionally, certain problems impede the full use and enjoyment of recreational resources in the coastal zone.

1. Lack of Recreational Facilities

In 1971, the State Parks and Recreation Commission submitted a Comprehensive Outdoor Recreation Plan for Louisiana so that the Commission could qualify for federal financial assistance under the Land and Water Conservation Act.(1) A major theme of this plan is that critical shortages of adequate recreational facilities exist in the coastal zone of Louisiana and the rest of the state.

According to the preface of the study:

"Both nationally and in Louisiana there has been much public interest focalized on our recreation. Extensive studies by governmental agencies and private interests indicated conclusively that the demands by the ever increasing public population for wholesome outdoor recreational opportunities far exceed the supply of both in quality and quantity. Simultaneously, it is conclusively indicated that the national recreational resources are rapidly being diverted to other purposes, which could render these lands and water forever lost to outdoor recreation."(2)

Similarly, the Corps of Engineers has found that:

"Recreational development in the state has not kept pace with demand. Since 1940, the state's population has increased by about 40% with development falling far short. Existing facilities used for swimming, fishing, boating, camping and picnicking can accommodate only 28 and 18 percent of the 1970 and 1985 demand, respectively. The situation in the coastal area follows closely the overall situation throughout the state."(3)

A Department of Public Works 1965 inventory of recreational needs, while somewhat out of date, showed that the ranking of needs by 1985 would be as follows:

- (1) Swimming pools
- (2) Fishing
- (3) Swimming beaches
- (4) Picnicking
- (5) Nature Walks
- (6) Dry land hunting
- (7) Boating
- (8) Waterskiing
- (9) Group camping
- (10) Hiking
- (11) Tent and trailer camping
- (12) Wetland (waterfowl) hunting

According to DPW calculations, trends in the coastal zone and other areas of the state are much the same.(4) It should be noted that, of the 12 major needs, the top three are water-oriented. Two needs, fishing, and swimming beaches, are found predominantly in the coastal zone.

The primary problem is a shortage of developed recreational areas accessible to the public despite the availability of intrinsically suited areas. According to recent reports by the State Planning Office:

"Generally, public recreation areas are available in the State in greater proportion than nationally. Louisiana has more than one-half [actually two-and-one half] as many acres available per 100 thousand persons (50/1,000) [actually 50/100,000] as the national average which is 20 per 100 thousand. Yet while the State has more acres available for recreation per person, it has three times fewer recreation sites (about 7 per 100 thousand) compared to nearly 25 per 100 thousand persons for the nation as a whole. Recreation planning should strive to readjust this ratio.(5)

The demand for recreation is increasing with the rise in Louisiana's population--about 40 per cent since the 1940s. Further increasing the demand for recreation are more leisure time, longer vacations and shorter work weeks. Additionally, according to the State Parks and Recreation Commission, Louisiana residents exceed the national average for participation in outdoor recreation. This is evident especially in hunting, fishing, and camping for hunting and fishing purposes.(6)

The following paragraphs focus on specific recreation needs:

a. Swimming

Swimming is the most popular outdoor recreation activity and, at present, demand for swimming outlets greatly exceeds supply. At the current rate, the need for swimming pools and beaches will nearly double by 1985. Much of the demand is being satisfied by pools, undeveloped streams, lakes and reservoirs, but there is a critical shortage of beaches developed for public recreation in the coastal zone.(7)

Some undeveloped beaches are found along the coastal zone Gulf shoreline and along the barrier islands. However, inaccessibility and too few public facilities, e.g., bathhouses, sanitary facilities, and trash receptacles, detract from their acceptance by the public. Moreover, many of the areas may not be naturally suited for recreation because much of it is marsh and not conducive to such development. The Commission believes that these undeveloped areas should be assessed to determine their suitability for beach recreation.

b. Bicycling (Pedal-Propelled)

Bicycling ranks second in outdoor recreation participation. However, no bike ways or bike paths are in the coastal zone. The State Parks and Recreation Commission suggests that it would require little expense to mark bike ways in highlands along lesser traveled country roads and within large recreational areas such as parks. A problem is that high land in the coastal zone is covered with roads. Bike ways could be placed in highland areas along scenic country routes connecting scenic, historical and recreational areas. The State Parks and Recreation Commission also suggests that agencies responsible for outdoor recreation should be encouraged to incorporate bike ways into their plans. This would be applicable especially in the beautiful upland Florida Parishes, where pipeline and powerline rights-of-way could be used to good advantage as bike ways. However, utilization of the rights-of-way involves legal procedures in that they are privately held.

Motor-propelled cycles or bikes could be accommodated by highways, roads, or strips along them designated as "motor-propelled cycle or bike ways."

c. Sightseeing and Driving for Pleasure

Sightseeing and driving for pleasure are favorite recreational activities. The coastal zone is rich in scenic attractions, but there are no established systems for scenic highways and roadways in highland areas. Toledo Bend Reservoir road in west-central Louisiana has been planned with proposed scenic highways and parksites. Perhaps Toledo Bend Reservoir Road could be used as a model for developing scenic highway systems in the coastal zone. Indeed, in the coastal zone, one finds many beautiful roads, such as the Old Mississippi River Road and the Azalea Trail, which could be converted into scenic highways. Road parking areas, scenic outlooks, roadside rest areas and picnic areas could be attached to these highways. The State Planning Office has recommended that wayside, rest or picnic areas be built along scenic highways where there are antebellum homes, geological and botanical attractions, or scenic streams.

d. Outdoor-Game Playfields

The State Parks and Recreation Commission study indicates a pervasive need for outdoor-game playfields.

e. Water-Based Recreational Activities

Water-based activities include fishing, boating, water skiing, canoeing, sailing, crawfishing, crabbing, floundering, frogging and shrimping. Lakes, rivers and bayous are the favorites of coastal zone residents for water sports. The State Parks and Recreation Commission reports it is certain the demand for recreational water facilities will continue to increase rapidly. According to the Commission, access to water for skiing, recreational fishing, and motor-boating is far below needs, which are expected to increase dramatically over the future years. One exception may be canoeing, a popular sport, because it appears that facilities for canoeing will be adequate in future years in most areas. The State Parks and Recreation Commission is aware of the need for parking and restroom facilities on streams suitable for canoe trips.

f. Hunting

Hunting is a traditional sport enjoyed by thousands of people. However, according to the State Parks and Recreation Commission, "If present trends of urbanization and increasing population, intensified industrialization, and large scale agriculture production of such crops as soybeans continue, hunting in the state will soon be in short supply." (8) According to the State Planning Office:

"At the present time. . . the amount of needed land for wildlife hunting exceeds the land available in game management areas. Double the amount is needed by 1985. By the year 2000 it is estimated that. . . 47,312 wetland acres must be acquired to meet projected recreation hunting needs."(9)

Some landowners have opened land to unrestricted public hunting and others allow hunting by permission. More landowners should be encouraged to make their lands available to the public for this kind of use.

g. Camping

Weekend camping which has experienced a 953 per cent increase recently, is the fastest growing outdoor recreational pastime. Yet, according to the State Parks and Recreation Commission, the need for acreage for tent and trailer camping is critical. Using campgrounds in excess of carrying capacity, is leading to destruction of scenic and aesthetic values. Present demand cannot be met by the overcrowded, congested public and private campgrounds, whose design and carrying capacity render them inadequate.

h. Horseback Riding

Horseback riding is found only in highland areas, predominantly less traveled roads, fields, forests and on the few designated horse trails. Opportunities for horseback riding in or near urban areas are extremely limited. The farms and ranches near cities could offer horseback riding on a user fee basis to relieve much of the demand. According to the State Parks and Recreation Commission, large public lands should be opened, when possible, for horseback riding, and agencies with land holdings should be encouraged to provide facilities. Parks in highland areas also offer potential for horseback riding trails.

i. Hiking Trails

The number of developed hiking trails and nature walks is inadequate. An abundance of natural areas would be suitable for hiking trails and nature walk development, with the proper planning.

j. Golf

The State Parks and Recreation Commission recognizes the need for more public golf courses near urban centers.(10)

k. Bird-watching

Louisiana has many species of birds and offers a wide variety of bird habitats. The coastal zone is in the southern terminus of the Mississippi flyway and receives almost unbelievable numbers of migratory birds, many of which winter in Louisiana. There are many bird-watching clubs and many people attract the birds with backyard feeders. Bird-watching can be enjoyed simultaneously with other recreation. According to the State Parks and Recreation Commission, nature trails should be developed in suitable areas to increase opportunities to watch birds. Constructing feeders in marshes and swamps is a means of observing all forms of wildlife which inhabit these areas. In addition, Louisiana has many state and federal refuges, many state wildlife management areas and private refuges with great potential for bird-watching.

l. Historical Sites

According to the study of the State Parks and Recreation Commission, the state must strengthen its historic preservation program by systematic and competent appraisal of the historic significance of various sites. Further, since Chalmette Battlefield in St. Bernard Parish is Louisiana's only historic site administered by the National Park Service, it is felt that the state should take all appropriate action to get federal assistance programs for historic preservation.

m. Wildlife Management and Refuge Areas

The difference between a wildlife management area and a refuge is that a wildlife management area is opened regularly for hunting but hunting is not allowed on a refuge. The refuges are used as resting places for waterfowl. Table 6.1 provides data related to:(11)

--wildlife management areas leased to or owned by the State of Louisiana in the coastal zone,

--wildlife refuges owned by the State of Louisiana in the coastal zone, and

--wildlife refuges owned and supervised by the U.S. Department of the Interior in Louisiana.

STATE OF LOUISIANA WILDLIFE MANAGEMENT AREAS

<u>Name & Parish</u>	<u>Date Acquired</u>	<u>Acreage</u>	<u>Ownership</u>
Biloxi St. Bernard Parish	Oct. 14, 1968 Lease Expiration Oct. 14, 1978	39,583	Biloxi Marsh Lands Corporation
Bohemia Plaquemines Parish	1968 Lease expiration Dec. 16, 1993	33,000	License - New Orleans
Bonnet Carre St. Charles Parish	1957	3,789	License - U.S. Army
Pass-a-Loutre Plaquemines	1921	66,000	Title was passed from State of La. to Dept. of Conserv. Act 52 of 1921
Pearl River St. Tammany Parish	Dec. 1971	16,732	Purchased by La. Wild Life & Fisheries Commission
Pointe-au-Chien Terrebonne & Lafourche Parishes	1968	28,243.88	Purchased by La. Wild Life & Fisheries
Sabine Island Calcasieu	July 31, 1968 Lease Expiration July 31, 1993	8,103.39	Owned by State of Louisiana

Table 6.1

<u>Name & Parish</u>	<u>Date Acquired</u>	<u>Acreage</u>	<u>Ownership</u>
Salvador St. Charles	1968	27,498.83	Purchased by La. Wild Life & Fisheries Comm.
Wisner LaFourche Parish	May 13, 1968 Lease Expiration May 13, 1978	26,310	Edward Wisner Donation Advisory Committee
Zemurray Tangipahoa	1965 Lease Expiration Dec., 1980	5,294.88	Zemurray Estate
State Wildlife Vermillion Parish	Nov. 4, 1911	13,000	Donated to State by Ward-McIlhenny
Marsh Island Iberia Parish	Nov. 6, 1920	79,000	Donated to State by Russell-Sage Found- ation
Rockefeller Vermillion & Cameron Parishes	Nov. 8, 1920	86,000	Donated to State Rockefeller Foundation
St. Tammany St. Tammany Parish	Jan. 31, 1938	1,600	Purchased by Dept. of Conserv. from Great Southern Lumber Co.
Sabine National Wild- life Refuge Cameron Parish	(Federal Refuge)	142,717	U.S. Dept. of the Interior

Fig. 6.1 (continued)

<u>Name & Parish</u>	<u>Date Acquired</u>	<u>Acreage</u>	<u>Ownership</u>
Lacassine National Wildlife Refuge Cameron Parish	(Federal Refuge)	31,125	U.S. Dept. of the Interior
Delta National Wild- life Refuge Plaquemines Parish	(Federal Refuge)	48,834	U.S. Dept. of the Interior

Fig. 6.1 (continued)

2. Degradation of Scenic and Aesthetic Resources

a. Pollution

According to the State Parks and Recreation Commission:

"Although Louisiana does have an abundance of water, much of it is presently inaccessible or unsuitable for recreation use. . . . Many lakes, rivers, and streams in Louisiana are unsuitable for recreation due to dense aquatic vegetation such as water hyacinth, alligator weed, etc., shallow water, the presence of trees, stumps or other obstacles; and industrial, agricultural, and domestic pollution."(12)

Water pollution problems in the coastal zone often have an adverse effect on recreation. For example, Lake Pontchartrain and some waterbodies in Plaquemines Parish have been restricted for types of recreation on frequent occasions.(13)

b. Erosion

According to the U.S. Army Corps of Engineers, significant shoreline erosion along the entire coast of Louisiana is causing degradation of scenic and aesthetic resources available for recreation.(14)

c. Alteration of Streams

An evaluation of Louisiana's streams conducted by the Louisiana Wild Life and Fisheries Commission showed that, of 63 major streams in the state, only 12 were unaffected by flood control, drainage, and navigation projects of public agencies.(15) According to the State Planning Office:

"Over 75 per cent of the streams have been changed or were scheduled for projects which would drastically alter their appearances. Reservoir construction, channelization, and clearing and snagging projects were the most prevalent means used by the government in their flood control and drainage programs. Yet channel

excavation is the most damaging of the stream improvement practices. Stream disturbance projects have destroyed more stream miles than pollution, and Louisiana is rapidly losing all its natural streams and rivers to such construction programs. Clearly, a priority decision must be made even if a few are to be preserved for scenic recreation purposes."(16)

According to the State Parks and Recreation Commission:

"Recent wholesale clearing of bottomland hardwood, the soybean production and flooding for impoundments has caused a critical shortage of suitable wildlife habitat in the state of Louisiana. . ."(17)

d. Lack of Public Access

Existing natural resources of the coastal zone provide a firm basis for meeting present and future recreational needs. However, because of under development, much of coastal Louisiana is currently not readily accessible.

According to the State Parks and Recreation Commission:

"Although Louisiana does have an abundance of water, much of it is presently inaccessible or unsuitable for recreational use. In Louisiana the basic problem in planning for these activities is providing access to water suitable for recreation. . . . Many acres are suitable for outdoor recreation but lack access. Access can be provided by boat ramps, boat hoists, rental boats, or fishing wharfs or piers."(18)

Another problem relating to access is the shortage of recreation facilities in urban areas.(19) Since there are several major urban areas in the coastal zone, large portions of the population, particularly the urban poor, are deprived of ready access to coastal zone recreation areas. It has been suggested that there is a need for "pocket parks" or "mini-parks," small acreages of urban terrain devoted to recreational purposes.(20)

According to the State Parks and Recreation Commission still another problem is the lack of facilities, and consideration for the outdoor recreation needs of the aged, handicapped and those otherwise incapacitated.(21)

B. Untapped Recreation Potential in the Coastal Zone

1. Multiple Use of Levees and Batture

Many miles of artificial levees winding throughout Louisiana's coastal zone have for their sole purpose the protection of lowlying adjacent lands from flooding. Because of the periodic nature of flood stages, many acres of batture (land between the levee and water source) are, during many months of the year, dry and suited for recreation. The State Parks and Recreation Commission recommends that attempts be made to coordinate efforts among state and federal levee authorities to zone levee and adjacent batture in suitable areas for hiking, horseback and cycle trails, and other recreation.(22) Multiple use of levee and batture lands for recreation would offer many advantages: linear parks following population densities and the major rivers, open space and recreational camping sites close to historic and cultural locations, such as plantation homes. However, commercial and industrial interests are currently using batture and levee lands in certain areas (e.g. for barge docking). Therefore, the Commission believes that commercial and industrial uses of levee and batture lands should predominantly occur in areas other than where recreational uses take place.

2. Lake Pontchartrain

Lake Pontchartrain fulfills many of the water-based recreation demands of the New Orleans metropolitan area. On the other hand, competing demands on the lake, e.g., dredge and fill, urban and residential development, sewage disposal, shell dredging, hurricane protection, and mineral development,(23) are diminishing the lake's capacity for public recreation. Proper planning could reconcile the competing demands and maximize the public's access to recreation in the lake.

3. The Old Mississippi River Road

Along the Old Mississippi River Road between New Orleans and Baton Rouge, there is a legacy of state history, plantation homes and their surroundings, all of which are a part of Louisiana's distinct cultural heritage. According to the State Planning Office:

"While the River Road is still one of the most scenic in the state, legislative measures should be taken to preserve these surroundings as well as to serve the needs of growing industries. This can be accomplished by effective zoning to insure that green and open spaces will remain attractive. Should the road become an official scenic route, a program of scenic picnic sites or wayside areas and recreational uses of the levees is highly recommended."(24)

Recreational uses of the levee and batture by the public require that access be provided by roads over the levee and batture. Scenic viewing of the river and batture could be provided by short (a mile or so) strips of road on top of the levee, easily accessible to travelers on the old Mississippi River Road.

4. Atchafalaya Basin

The Atchafalaya Basin, containing about 585,000 acres of swamp, is an outstanding wilderness areas.(25) The Governor's Commission on the Atchafalaya Basin, and the Atchafalaya Basin Division of the Louisiana Department of Public Works, were created by the 1972 legislature to formulate a land and water use plan for recreational use of the Basin.

5. Swamp Tourist Attractions

Various groups have recommended establishing swamp tourist areas, with boardwalks in the swamps, guided tours, visitation centers, nature preserves and educational opportunities, all with an emphasis on observation rather than use. Such facilities would allow tourists to see swamps and swamp animals and would promote a consciousness of the vast value of our coastal estuarine area.(26) Similar development should be considered in other areas.

6. Pearl River Basin

The State Parks and Recreation Commission recommends developing recreational opportunities in the Pearl River Basin. The Commission feels that development of facilities in the basin would provide outdoor recreational opportunities to the metropolitan area of New Orleans.(27)

7. Great River National Park

The Department of Public Works recommends that a "Great River National Park," accessible only by boat, should be established at the mouth of the Mississippi River. Such a park would allow people to view the delta-building process, the mud lumps, wildlife, and other natural phenomena which characterize the mouth of one of the greatest rivers in the world and one of the most unusual deltaic processes.(28)

8. Multiple Use of Private Lands

Much of the marsh, swamp, and forest land of the coastal zone is privately owned. Perhaps, careful multiple-use land management concepts could be developed on these lands, with an emphasis on enhancing recreational potential for the public.

9. Plantation Homes and Other Historic Buildings

There are a large number of beautiful antebellum plantation homes in Louisiana, particularly along the old Mississippi River Road, Bayou Lafourche and Bayou Teche. The recreation and tourism potential of these homes is relatively untapped. Many are historic spots, whose culture is rooted in the antebellum agrarian economy of South Louisiana. In addition, the many fascinating little communities and other historical buildings should be revitalized and used as recreation, culture and tourism centers. The state could play several roles in the restoration of these homes and buildings. The State Parks and Recreation Commission could purchase and restore the old homes and buildings. (At present, Oakley House is the only home owned by the state.) Louisiana could also establish for these historic spots a directory system coordinated with a state scenic highway system as follows.

10. Scenic Highway System

Several agencies have recommended establishing a scenic highway system in highland areas on existing roadways to serve the recreational sites. New recreational areas would be developed adjacent to these scenic routes. These highways would intersect major highways and be within an hour's drive of major coastal zone cities. In addition to serving the recreation units, the scenic highway system would pass through major landscape areas of the state, including historic homes

and other historic buildings, and would offer the motorist a vivid picture of attractions in the Louisiana coastal zone. off-road parking areas, scenic overlooks, roadside rest areas, and picnic areas would be available.(29)

C. Policy Problems

1. Lack of Adequate Funding

One of the major problems impeding development of a comprehensive recreation system for the coastal zone of Louisiana is perennial: insufficient funding of state agencies with recreational responsibilities. For example, not enough funds are available to acquire park sites (30), for proper administration of the Natural and Scenic Rivers System, for acquiring game management areas(31), or building access roads.

2. Lack of Recreational Policy

As pointed out in the Commission's first annual report and exemplified by the controversy over commercial development of Fontainebleau State Park, policy for defining how public park areas ought to be utilized and preserved is nonexistent.

Another example of lack of recreational policy is the current controversy over how the Natural and Scenic Rivers System should be administered. The Natural and Scenic Rivers System designates 35 streams to be preserved and names the Wild Life and Fisheries Commission as the state agency to administer the system. The act also provides that the Wild Life and Fisheries Commission shall purchase scenic and surface easements for recreational purposes. Yet, the Wild Life and Fisheries Commission is given no guidance or guidelines for administration of this system.

3. Lack of Systems Approach to Recreation

In the past, there seems to have been a want of a systems approach for coastal zone recreational facilities to tie together the different recreational elements into a system for the entire coastal zone. Perhaps, the Natural and Scenic Rivers System, multiple use of levee batture for recreational purposes, swamp parks, and the scenic highway system, utilizing such roads as the old Mississippi River Road, etc., could

be blended to interlace the coastal zone and provide incalculable recreational, tourism, and cultural opportunities for everyone. However, zoning, land use controls and adequate funding would be necessary for development of such a system for the coastal zone.

D. Economics of Recreation

The economic value of recreation in the coastal zone has not been proved nor is it understood. If coastal recreation, in all its forms and ramifications, can be called an industry, it can rank at least a close third to the mineral and agricultural industries in economic importance. For example, sports fishermen harvest in excess of 100 million pounds of estuarine fishes annually. The recreational value of the Louisiana coastal zone for sports fishing alone has been estimated at \$92 million.(32) Other economic values of coastal zone recreation are not always recognized. Those include: revenues from recreation related to tourism, "new" money brought into localities by nonresidents attracted by the recreational opportunities, increased attractiveness of the coastal zone for certain types of labor-intensive businesses because the coastal zone is a desirable place to live, and business opportunities through direct service to recreationists, e.g., sales of paraphernalia of outdoor recreation, boating, etc.

However, economic benefits of the coastal zone should be considered in the context of coastal ecology and quality of life.

The Sea Grant Program of the University of Wisconsin states:

"Recreational utilization and development should be encouraged but not at any price. We can no longer pursue the short range improvement of human existence at the expense of long range environmental repercussions that eventually return to man. In increasing the recreation utilization of the marine environment, we must, through ecologically sensitive technology and user-resource planning avoid the disasters wrought on many of our inland lake resources. This includes filling, peripheral development, and accelerated eutrophication."(33)

Perhaps recreational zoning or recreational land use policies could be developed so that certain ecologically sensitive or fragile areas in the coastal zone can be preserved in their wilderness state. However, these policies should also allow for developing other areas for various levels of recreational activities.

E. Possible Adverse Effects of Recreation

Although the Commission recognizes the positive effects of recreation, it believes there are also negative effects, namely, from an ecological standpoint. These include:

1. Problems attendant to the disposal of sewage generated by recreationists.
2. Litter (solid waste).
3. Loss of habitat through noise, trampling and cutting of vegetation, and construction of physical facilities.
4. Adverse environmental effects of establishing access routes to recreational sites.
5. Increased erosion from excessive use.
6. Loss of wilderness characteristics and ecosystem changes because of commercial recreational development.

F. Conclusions and Recommendations

1. While the Commission recognizes recreation is a positive value for the coastal zone, the Commission also believes that recreation has at times caused problems and has competed with other values and uses of the coastal zone. Among these are ecology, commercial fisheries and trapping, development of navigation facilities, mineral production and timber production. The Commission believes that recreation uses of the coastal zone must be carefully balanced against other values and uses. To attain the appropriate balance, the Commission recommends the following:

a. Every effort should be made by the Stream Control Commission and other responsible agencies to provide stricter and more systematic enforcement of state water pollution control laws.

b. The Coastal Resources Commission should develop a use plan for Lake Pontchartrain to facilitate recreation in the lake and reconcile competing demands on the lake, such as those for dredge and fill, urban and residential development, shell dredging, hurricane protection, mineral development, and recreation.

c. The Coastal Resources Commission should develop a comprehensive recreation policy which would provide resource decision-makers with guidelines explaining how land and water use decisions relating to recreation are to be made. Park use and administration of the Natural and Scenic Rivers System are examples of such decisions. The basic thrust of the policy would be to provide for recreation while protecting ecologically sensitive or fragile areas in the coastal zone. However, the policy should also allow for development of other areas for recreation.

d. Recreational elements should be linked into a recreational system for the coastal zone. The Natural and Scenic Rivers System, multiple use of batture lands for recreation, and the Scenic Highway System would all be tied together in such a system.

2. Although the coastal zone of Louisiana has certain land and water areas intrinsically suitable for recreation, many of these areas are unusable for recreation because of inadequate public access. As a result, public demand for wholesome outdoor recreational outlets far exceeds the accessible supply in quality and quantity. To alleviate the problem, the Commission recommends that the following actions be undertaken, all consistent with other important values of the coastal zone.

a. Recreation planning by the State Parks and Recreation Commission and other agencies should seek to establish adequate numbers of publicly accessible sites in the coastal zone.

b. The state legislature should provide adequate funding for development of a recreational system for the coastal zone.

c. Cycle, foot and horse trails should be built in appropriate parks and along scenic country routes, with each use being independent of the other.

d. Continual effort should be made between state agencies and private landowners to provide hunting on private lands, with adequate incentive for landowners who make their lands available. However, statutory or contractual measures should be encouraged to relieve from liability landowners who open their lands to sportsmen.

e. Construction of boat ramps, fishing wharfs or piers should be encouraged in selected areas.

f. Careful multiple-use land management concepts should be encouraged on private lands, with an emphasis on furthering their potential for public recreation.

g. Additional camping grounds with appropriate sanitary facilities should be provided in dry-land areas of the coastal zone.

h. Hiking trails and nature walks should be constructed in dry-land areas of the coastal zone.

i. "Pocket parks," or "mini-parks"--small acreages of urban terrain devoted to recreation--should be developed.

j. The State Highway Department should institute a scenic highway system for highways in the coastal zone, particularly in areas with geological, botanical or scenic attractions. The old Mississippi River Road and the Azalea Trail should be designated officially as scenic highways.

k. Appropriate open spaces, off-road parking, picnic areas and roadside restaurants should be attached to the scenic highways.

1. The U.S. Army Corps of Engineers, New Orleans District, the Department of Public Works, the levee boards and private landowners should open available levee, batture and floodway lands for multiple recreational use for such things as camping, hiking, nature trails, horseback riding, and cycle trails, with due consideration to commercial interests.

m. Coastal zone beach areas suitable for recreation should be developed and made accessible to the public.

3. The Commission recognizes that within the coastal zone are unique natural estuarine and deltaic processes. To promote better appreciation of these processes, the Commission recommends the following:

a. Swamp parks should be established in certain swamp areas and placed under the direction of the Louisiana Wild Life and Fisheries Commission. Included would be boardwalks, guided tours, nature preserves and education opportunities. The emphasis would be on observation rather than physical use so as to preserve the areas in their natural state.

b. A site should be established at the mouth of the Mississippi River as an observatory for deltaic processes.

III. CULTURE

A review of some of the distinct cultural and historical values found only in south Louisiana may provide a more vivid perspective of the people living in the coastal zone.

A. Architecture

Until recently, architectural form in Louisiana's coastal zone has been integrated totally with the ecology of the area. Plantation homes of French, Greek Revival and many other architectural styles lace the waterways, the centers of commerce of the antebellum era. Old museums, churches and forts are also distinctive architectural elements of the coastal zone.

Hip roofs and large overhangs kept out semitropical rains; louvered, movable shutters were the nineteenth century counterpart of air-conditioning. Homes on stilts were the answer to periodic flooding. It seems, however, that much of this natural architectural form is being supplanted by forms which are not in harmony with the natural environment.

B. Festivals

Yearly, throughout the coastal zone, there are many festivals and celebrations which reflect the lifestyles of south Louisianans. All have a unique south Louisiana flavor resulting from the merging of different cultures in the coastal zone and the varied customs that still survive. Mardi Gras, the Cochon de Lait, the Crawfish Festival, pirogue races, the Jambalaya Festival, Fais do do, country dances and Cajun fiddles are all important parts of the distinct cultural heritage of the coastal zone.

C. Music

French and Spanish colonial regimes in Louisiana were superior to English regimes on several counts, one of the most important being tolerance for the life styles of the divergent cultures. In Louisiana, African slaves were permitted to continue their musical and social traditions within broadly defined limits, while their freedom of expression was suppressed ruthlessly in English colonial cities of Charleston and Savannah. Musicologists say that is the reason jazz originated in New Orleans rather than in Charleston or Atlanta. The surrounding area of New Orleans is rich with the folk music of the Acadians, and the country and Negro music of the rural south. Some twentieth century popular music owes more to Louisiana than to any other geographical region in the nation.

D. Cuisine

Creole cooking--gumbo, jambalaya a l'acadienne, crawfish bisque, redfish courtbouillon--is part of a distinctive and subtle cuisine developed through the centuries into one of the great cooking styles of the world. Creole cookery is an amalgam of several cultural strains--the economy of provincial French, tropical lushness of the Indies, and hot spices of the Spanish. With the rich fishery harvest of the coastal zone, this amalgam has produced the most distinctive of all American cuisines.

Accompanying this development is the conviction that the food must be savored, not merely devoured. Even in times of near famine, cleverly contrived foods and food combinations, such as chicory "cuts" in scarce coffee, were developed, and slaves subsisted on leftover "greens" from the master's table. Coastal zone residents and tourists can dine in the spectacular New Orleans French restaurants or little out-of-the-way cafes all over the coastal zone.

E. Conclusions and Recommendations

The Commission recognizes the existence of a distinct South Louisiana culture and history of positive value which adds to the quality of life of people living within the geographical boundaries of the coastal zone. So that these values may be preserved and enjoyed by more people, the Commission recommends the following:

1. If the scenic highway system is established as recommended herein (II F 2j), it is recommended further that the scenic highways be designated in the vicinity of antebellum homes to provide additional access to them.

2. The Historical Preservation and Cultural Commission should establish a directory system for historical and cultural spots in the coastal zone. The system would coordinate with the Scenic State Highway System.

3. The State Parks and Recreation Commission should purchase and restore as many old plantation homes and historic buildings as possible.

IV. TOURISM

Tourism is closely tied in with recreation and culture because much of the tourism potential of the coastal zone is directly dependent on recreational and cultural opportunities. Tourism is an important coastal zone industry which should be developed so long as this development is balanced carefully with other coastal zone values.

For example, in 1971, 14 million out-of-state visitors spent \$420 million and the total tourism spending was \$650 million.(34) (Coastal zone figures are not available but it is assumed that spending was higher in the coastal zone than in any other single area because New Orleans and other tourist attractions are part of the coastal zone.) In this context, it should be noted that Louisiana spends substantially less promoting tourism than many other states. For example, Louisiana spends \$85,000 on such promotion but the state of Virginia spends \$650,000.(35)

To promote tourism properly in the coastal zone, the state must develop mechanisms for informing and educating Louisiana residents and others of the vast recreational and cultural opportunities of the coastal zone. One problem in this regard has been inadequate promotion of the rural recreation and cultural opportunities of the coastal zone. Louisiana sends out tourist brochures displaying moss-draped cypress trees, swamps, antebellum homes and other historic sites of the coastal zone, but the state tourism industry never really directs tourists to the rural areas. Generally, they are directed to Bourbon Street in the New Orleans French Quarter.

State government must realize that tourism development, in consonance with the natural and environmental values of the coastal zone, offers great human and economic potential.

A. Possible Adverse Effects of Tourism

While the Commission realizes the positive effects of tourism, it also recognizes negative effects stemming from ecological considerations. (For a listing, see II E 1-6.)

B. Conclusions and Recommendations

The Commission recognizes that tourism in the coastal zone is an important industry which should be developed, provided this development is balanced carefully with other coastal zone values. To develop tourism in the coastal zone, the Commission makes the following recommendations.

1. The Tourist Development Commission should foster, with the proper environmental protection measures, tours in certain carefully defined areas of the coastal zone.

2. The Tourist Development Commission should promote adequately the rural recreation and cultural opportunities of the coastal zone.

3. The Tourist Development Commission should devise mechanisms for informing and educating Louisiana residents and others of the vast values and unique qualities of the Louisiana coastal zone.

4. The legislature should be encouraged to appropriate more money to the Tourist Development Commission for promotion of tourism opportunities in the coastal zone.

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CHAPTER SIX
Special Programs for Louisiana's Coastal Zone

SECTION FOUR
New Developments of Significance
To Louisiana's Coastal Zone

The coastal zone, one of Louisiana's most valuable resources, is important not only for its contributions to the state's economy, but also for scenic beauty, recreational uses and its role as a buffer zone protecting populated areas from storm surge.

Spurred by advances in research and technology, the coastal region is becoming subject to new uses. Careful research is needed to explore the important economic and social benefits of these new uses. Environmental impacts and stresses which might affect living and non-living resources must be examined.

The Commission feels that it would be beneficial to examine some of the areas where research into these new uses is in progress. The state should promote further research and experimentation in these areas so that their potential can be analyzed intelligently and realistically..

Salt Domes

The vast quantities of domal and bedded salt in Louisiana's coastal zone are part of this potential. For example, the salt may be of use in solving disposal problems. Salt is impermeable to liquids and gases. It often occurs in the subsurface as thick tabular bodies and massive intrusives. Because of these characteristics, salt deposits may be valuable for waste storage. The potential for utilizing bedded salt for disposing of high-level radioactive wastes has been demonstrated by industry. Perhaps techniques could be developed to allow for disposal of such wastes in domal salt cavities. With the growth of the nuclear power industry, these possibilities are timely, but not without such problems as the possibility of triggering movement through heat from radioactive decay. Salt domes have a high temperature due to the depth at which they exist. Because of these high temperatures and the excellent heat conductivity of salt, perhaps other wastes, even solid wastes, could be disposed of in solution cavities of certain salt domes and their degradation accelerated by the higher temperature.

*New developments have been discussed in Chapters Two and Four of this report, as well as other sections of Chapter Six.

Another possibility for utilizing abandoned mines or solution cavities in salt domes involves their use as holdover chambers for compressed air in the storage of off-peak electrical energy. The idea of air compressed by low-cost energy has been explored in West Germany. A variation, using a reversible compressor-expander, has been suggested in Louisiana(1). The energy would be reclaimed by leasing the stored air through the compressor-expander to generate power. Elevated temperatures within the salt would be utilized to increase the efficiency of the operation.

Also proposed has been the generation of methane gas from organic wastes(2). Abandoned salt domes are suggested for use as containment vessels for wastes during the generation process. One technical problem is related to the salt dome temperature which would not be sufficient to support the anaerobic decomposition of the organic materials (the process of generating methane gas). However, it is suggested that enough heat will be generated by aerobic decomposition within the dome to sustain the process. This process, if and when developed, could serve the two-fold purpose of serving as a sewage disposal technique and a means of natural gas generation.

Use of Marsh for Waste Treatment

Wastewater effluent has caused several major problems in Louisiana waters. Among these are odoriferous conditions, possible harmful algal growth, eutrophication of still and running waters accompanied by diminution of dissolved oxygen, and large fish kills. It has been proposed that marshlands be used to treat such wastewater. The theory behind the utilization of marshlands for degradation of organic wastewater is that the natural system of the marsh, already eutrophic, will not be broken down by recycling these organic materials. The organic and nutrient levels will be reduced to background concentrations by indigenous bacteria and fungi.

Currently, research is being done on land and marsh leased by a menhaden processing plant in Dulac, La., to record and analyze the interaction of plant and animal life with the wastewater(3).

The plan includes pumping menhaden wastewater effluent over a dredge spoil area. From there, the water would drain into the submerged area of the spoil and gradually mingle with the marsh, where degradation would be completed. Finally, the processed water would be discharged into the Houma Navigation Canal.

The successful completion of this system could yield scientific information applicable to agronomic use, e.g., sugar cane irrigation. The treatment of these waters is simple and inexpensive compared to other treatment requirements and it may lend itself to processing wastes. The idea is perhaps adaptable to pollution abatement and marsh enrichment. The basic concept of effluent disposal has been applied to irrigation, fertilization and ground-water recharge. These ideas have been used on large areas in California.

The system has the potential to provide inexpensive and simple sanitary engineering techniques and at the same time enrich the natural resources that support the productivity of Louisiana's estuaries and marshes.

Controlled Deposition of Sediment

Several factors have contributed to the widespread deterioration of wetlands. These include erosion, subsidence, compaction, and acts of man. Because of the importance of maintaining high natural productivity in this area, research into checking this deterioration is in progress.

Historically, the coastal marshes of Louisiana were developed gradually by deposits of sediment transported by the Mississippi River during regular floods. However, little marsh building is occurring today because most of the water and sediment of the river is contained within man-made flood protection levees and reaches the Gulf of Mexico through four major passes. The mouths of these passes are close to deep water at the edge of the continental shelf. As a result, the sediment is dumped into the Gulf's oceanic deep and not into shallow areas suitable for the development of subdeltas. Currently in Louisiana, when land is lost to erosion or subsidence it is not regained at a comparable rate. New deltaic lands could be developed by controlled diversions of river flow into suitable shallow estuarine areas. Several potential subdelta sites have been identified by researchers⁽⁴⁾.

Barrier islands are a possible method of minimizing erosion along the muddy shorelines of large lakes and bays, according to some current research. Considering that Louisiana has more than 30,000 miles of land-water interface south of the Gulf Intracoastal Waterway, much of which is eroding, control of erosion is extremely important. The proposed islands, one-quarter to one-half mile long, would be separated from the shore by a shallow lagoon. Barrier islands would consist of a rigid core of interlocking metal sheet piles, concrete tetrahedrons or similar rigid material. Surrounding the core would be sediment from lake or bay bottoms. Gravel, shell or other coarse material

would protect the seaward side of the islands to absorb wave energy. Tidal passes separating the islands would be lined with rigid, erosion-resistant material. The lagoon side of the island would be planted with marsh grass.

It has been reported that, although construction would be expensive, there are a number of advantages to barrier islands, among them prevention of erosion and reduction of storm surge without destruction of natural land water interface along the estuary margin. Marshes and swamps inland from the coast could be maintained in a natural condition.

Additionally, it has been suggested that man-made barrier islands be placed on the margins of large lakes and bays in places where the wetlands are of high value, e.g., estuarine nursery areas and wildlife habitats, or high recreational value.

Alternate Uses of Offshore Platforms

Presently, oil companies maintain offshore structures for drilling and producing oil and natural gas. Ports for deep-draft vessels is a new use for offshore structures which will be developing in coming years.

Potentially, these offshore structures could be used for purposes beyond oil and gas production or port operations. Scientific observation, both oceanic and atmospheric, is a possibility. Underwater portions of structures could be used for mariculture operations with possible handling and processing facilities on the platform. Recreational fishing, already developed to some extent off many platforms, could be expanded. Platforms could be equipped as resorts, complete with restaurants, hotels and docking facilities. The structures could be maintained for commercial fisheries offloading and processing stations; so that fishing vessels could eliminate some of the expensive return trips to port.

Many of these new uses could be supported by the owners and operators of offshore platforms, whether oil companies or port authorities, and be compatible with the platforms primary function. However, it may be feasible for a state government to acquire a retiring platform, no longer being used commercially, to promote these new uses. Besides state-federal jurisdictional problems, the tremendous expense of maintaining a structure including lights, horns, scraping, painting, etc., presently makes the cost of using retiring oil and gas platforms by states prohibitive. Also, these structures must be removed when they are no longer in use and the cost of removal is extremely high.

As with many innovative ideas, problems to be solved are many, but with increased technology and public support, these uses of offshore platforms may not be so remote. A thorough

study of the problems and potential uses must be made.

Major Water Resource Projects

There are several major water resource projects under consideration in the Louisiana coastal zone; expansion of Gulf Intracoastal Waterway, infusion of fresh water for estuarine management and the diversion of Mississippi River waters to Texas. Careful examination of the environmental effects as well as foreseeable benefits must be carried out before action is taken.

The Rivers and Harbors Act of 1962 authorized the enlargement of the Gulf Intracoastal Water (GIWW), the plans for which were included in House Document No. 556, 87th Congress, Second Session. Because of the lack of local cooperation to provide rights-of-way, plans have not been implemented. The Gulf Intracoastal Waterway was opened in the 1930s and has served for tugboat and barge transportation. The U.S. Army Corps of Engineers has recommended enlarging it, except in developed areas or at existing structures, to 16 feet deep and 150 feet wide from the Mississippi River to the Houston Ship Channel. In the area between the Atchafalaya River and the Sabine River, the Gulf Intracoastal Waterway would be widened to 200 feet. Also recommended were three relocations, one of which would bypass Houma.

The Louisiana portion of the Gulf Intracoastal Waterway, which extends from Apalachee Bay, Fla., to Brownsville, Tex., is 266 miles long, about 12 feet deep and 125 feet wide. It traverses marshlands that are primarily estuarine in nature. The probable ecological effects of enlarging operations on the ecosystem of the marsh must be studied carefully(5).

Introducing fresh water into marsh areas for estuarine management is another proposed major water resource project. South of the Gulf Intracoastal Waterway, most of the area is fresh-to-brackish marshes, lakes, ponds and waterways. These marshes are extremely important elements of the estuarine area because they directly shelter migratory waterfowl, fur-bearing animals and commercial reptiles. Used for recreation and fishing, the area is important also for its scenic value. The marshes south of the GIWW form a buffer zone against flooding inland areas by storms.

Methods are being studied for providing supplementary freshwater for estuarine management to offset saltwater intrusion. This supplementary freshwater, introduced through control structures from the Mississippi and Atchafalaya rivers into the estuaries, could optimize the saltwater/freshwater balance. A surface water plan for the Terrebonne-Barataria area is forthcoming(6).

Another major water resource project has been proposed by Texas. Texas has a tremendous projected water need and the Texas Water Development Board is looking to the Mississippi River as the most logical water source to meet future needs. Their proposal involves the diversion of 12 million acre-feet of water per year to the High Plains of Texas. Such a diversion could seriously affect the volume of the river flow at New Orleans. Also, when the river flow is lowered substantially, salty Gulf water may move upstream into municipal and industrial intakes. Consequently, pumping the necessary water to Texas could threaten municipal Louisiana water supplies and increase corrosion of industrial equipment in industries using water for cooling. This project needs further careful study(7).

Mariculture

The marine environment holds a tremendous potential as a source of food. Research is taking place in the development of techniques for the culture and harvest of these resources. Mariculture, or sea farming, is the result.

Although pond culturing is growing rapidly in Louisiana today, e.g., increased culturing of crawfish and catfish, it is not technologically feasible to culture and harvest shrimp, a product of great demand in the state and the nation. Pond culture of shrimp would help in the prediction of the size of the shrimp crop.

In Louisiana, white and brown shrimp are caught commercially. Young brown shrimp come to coastal waters between February and March and are ready to be caught in May. In July and early August, young white shrimp develop near shore and are mature by late August.

Marsh culturing of shrimp by use of weirs and screens takes advantage of the tides and movement of the shrimp into the estuaries and out. This method of culturing utilizes the excellent natural environment already existing in the estuarine areas.(8)

The culturing of shrimp by enclosing areas of open water or extending enclosures from estuaries has been explored in Florida. The resultant increase in shrimp production and increased predictability brought about by ideal growing conditions may eventually be matched by technological advances to make the enterprise feasible. Besides the technical problems involved, there may be questions of jurisdiction and infringement on traditional uses (navigation, fishing and recreation) by the exclusive use of defined water areas. Issues relating to water quality, conflicts involving riparian rights and priority concerning mariculture and mineral leases, cables and pipelines probably will arise also.

In addition to shrimp culturing, research is being done into the effects of various salinity levels on crawfish and catfish growth and survival. The results of these experiments will determine the feasibility of raising catfish and crawfish in the marsh region.

Hovercraft

A new mode of transportation is beginning to find acceptance in the coastal region. Hovercraft, also called air-cushion vehicles and surface effect vehicles, are used in other parts of the world but are quite new in this area.

Surface effect vehicles differ from hydrofoils in that a hydrofoil is a motorboat with fins or plates attached by struts for lifting the hull clear of the water as speed is attained. The plates remain beneath the surface. Unlike surface effect vehicles, hydrofoils require fairly deep open water and consequently are not suitable for use in the Louisiana marsh.

A hovercraft is defined as "a vehicle capable of being operated so that its weight, including its payload, is wholly or significantly supported on a continuously generated cushion or bubble of air. The air bubble or cushion is put under pressure by a fan or fans and generally contained beneath the vehicle's structure by flexible skirts or sidewalls."

Several reasons exist for an interest in such craft. They can go much faster than standard boats and with smaller operation costs. Whereas a standard crewboat can attain a top speed of about 30 miles per hour in calm water, certain hovercraft of comparable size have attained speeds almost three times that fast. Also, with comfort as a criterion, the ride closely resembles that of a large airplane.

Problems associated with adaptability to operations in Louisiana have arisen but the hovercraft is close to becoming a reality in this region.

A firm in New Orleans has built an 80-foot hovercraft for the Navy. In tests on Lake Pontchartrain, the craft achieved a top speed of 82 miles per hour. The firm recently announced plans to design and, hopefully, to build the world's first oceangoing surface effect ship. The proposed new ship would be more than 200 feet long, weigh 2,000 tons and be expected to attain a speed of 115 miles per hour (about 92 knots) on the high seas.

A leading boat builder, with operations in Berwick, La., has constructed an air-cushion vehicle which it hopes to sell for use by the offshore oil industry.

A study is underway (9) to determine the feasibility of using hovercraft to service the offshore oil industry.

Only time will tell for a certainty how these craft can be used in this region but the possibilities are varied. They may be used to carry men and supplies to oil rigs in the Gulf and in the marshes, to carry commuters across rivers and lakes as part of a larger overall transportation system, or as pleasure craft in much the same manner as boats, helicopters and airplanes are used now.

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APPENDICES

APPENDIX ONE
Comprehensive Studies Affecting Louisiana's Coastal Zone

SECTION ONE
Report on Louisiana Coastal Area Study
U. S. Army Corps of Engineers
New Orleans District*

The Louisiana Coastal Area study was authorized by resolutions adopted by the Senate and House Committees on Public Works on 19 April 1967 and 19 October 1967, respectively. These resolutions, which are identical as to purpose and scope, authorize the study "with a view to determining the advisability of improvements or modifications to existing improvements in the coastal area of Louisiana in the interest of hurricane protection, prevention of saltwater intrusion, preservation of fish and wildlife, prevention of erosion, and related water resource purposes."

Initial funds to conduct the study were received in September of 1968. Public hearings were held in the same year at Jennings, Houma and New Orleans and were attended by a total of 290 persons. Numerous requests for project-type studies were received at the hearings. Principal concerns of local interests were improvements for navigation, hurricane protection and fresh water. Other needs cited included measures for control of alluvial flooding, beach erosion, saltwater intrusion, and requirements associated with access, recreation.

In preparing the plan of study, it was recognized that the coastal zone, because of the type of natural environment, is confronted with substantially more severe problems and complex issues than those encountered in other areas of narrowly defined land and water resources. Planning and management of the coastal zone for multiple use must be performed in such a manner as to accommodate the great diversity of compatible and conflicting activities, and to provide equitable and effective relationship between long-range interests and short-term uses of the area's resources.

A number of broad studies covering the entire coastal area were initiated to provide basic information on the vital forces at work affecting the use of water, marsh and land areas; to identify problems and to determine their seriousness and urgency; and possible means of solution.

A fish and wildlife study of the Louisiana Coast and Atchafalaya Basin is being conducted by an interagency group chaired by the New Orleans District to determine the fresh water needed to maintain an optimum environment for fish and wildlife. Work is continuing on a plan to optimize fish and wildlife values in the coastal area.

*This Section prepared by U.S. Army Corps of Engineers, New Orleans District

Agencies having particular responsibility for certain sections of the report include; U.S. Army Corps of Engineers, New Orleans District, Bureau of Sport Fisheries and Wildlife, National Marine Fisheries Service, Bureau of Outdoor Recreation and the Louisiana Wild Life and Fisheries Commission. Certain sections of the study will be conducted under contract by Gulf South Research Institute and the LSU Coastal Studies Institute.

The LSU Center for Wetland Resources was retained under contract to perform a number of studies concerned with hydrological and geological characteristics and trends in the area as a result of natural processes and the works of man; identification of significant environmental parameters; determination of fresh water requirements to implement changes recommended by the interagency group for fish and wildlife enhancement; development of measures to reduce environmental impacts; and, finally, preparation of a summary of the findings with recommendations on management and structural approaches to solving problems in the estuarine environment. Reports on a number of studies have been published and drafts have been made available on all outstanding reports.

Listing of titles of studies conducted under contract for Corps of Engineers by the LSU Center for Wetland Resources are:

<u>Report Number</u>	<u>Study Title</u>
1.	Geologic-Geomorphic Aspects of Deltaic Processes, Mississippi Delta System
2.	Salinity Regimes in Louisiana Estuaries
3.	Water Balance in Louisiana Estuaries
4.	Summary of Salinity Statistics, Coastal Louisiana Basin, 1946-1968
5.	Salinity and Temperature Atlas of Louisiana Estuaries
6.	Seasonal Precipitation Surplus and Annual Precipitation Deficit of South Louisiana, 1945-1969
7.	Louisiana Wild Life and Fisheries Water Chemistry Data, Louisiana Estuaries, 1968-1969
8.	Controlled Diversion in the Mississippi Delta System: an Approach to Environmental Management
8-S.	Hydrologic and Meteorologic Data from Coastal Louisiana, Evaluation of Data Gaps

<u>Report Number</u>	<u>Study Title</u>
9.	Deterioration and Restoration of Coastal Wetlands
10.	Selective Environmental Parameters, Coastal Louisiana, 1945, 1946, 1959-1965
11.	Statistical Model of Salinity Distribution, Southeastern Louisiana Estuaries
12.	Wave Energy Studies Along the Louisiana Coast
13.	Development of Atchafalaya Delta, Louisiana
14.	Canals, Dredging and Land Reclamation in the Louisiana Coastal Zone.
15.	Measurement of the Louisiana Coastal Shoreline
*	Hydrologic Model of Barataria-Terrebonne, South-Central Louisiana
*	Shell Dredging Industry: Its Impact on Louisiana
*	Vol. I, Summary Report: Multiuse Management Plan for South-Central Louisiana
*	Vol. II, Environmental Atlas and Management Plan for South-Central Louisiana

So far, the studies have yielded hard data and insight essential for the proper planning for effective use of the coastal area. Information available includes a preliminary or first cut quantitative need for supplemental fresh water in the estuarine areas to maximize productivity of fish and wildlife. Also, the rate of change of the land-water ratio in the coastal zone has been identified.

Initially, the findings in the broad studies are being applied in a pilot study essentially confined to the Terrebonne Parish area. The pilot study report will be followed by additional reports to serve as vehicles for authorization of any recommended projects in the Terrebonne area, or

*These reports have been issued in draft form and as yet have not been assigned a number.

other areas of coastal Louisiana to which knowledge gained in the pilot study can be applied. This procedure will permit reports on vital features to be processed more quickly than a report covering recommendations based on the broader overall investigation.

All ongoing studies, including the pilot study, are scheduled for completion in 1973. Firm dates for the completion of reports with specific recommendations to serve as a basis of authorization of improvements will be established following the completion of the pilot study.





APPENDIX ONE
Comprehensive Studies Affecting Louisiana's Coastal Zone

SECTION TWO
Report on Cooperative Gulf of Mexico
Estuarine Inventory and Study,
Louisiana *

The report was part of a multistate investigation of biological and physical characteristics of the coastal waters of the northern part of the Gulf of Mexico. It was intended to establish a baseline from which estuarine areas can be evaluated. The report is divided into four phases entitled: Area Description, Hydrology, Sedimentology and Biology. Six estuarine areas numbered I through VI were identified and information was examined and grouped largely on the basis of these study areas. Except for Lakes Pontchartrain, Maurepas and Charles north of the Gulf Intracoastal Waterway, the northern boundary of the study areas was the Gulf Intracoastal Waterway. The seaward boundary of the study was an arbitrary line drawn across several offshore islands. The base line period of the study was April, 1968 through March, 1969 but some information was reported over a longer period. A phase by phase summary of the work follows.

Area Description (Phase I)

Description of the physical characteristics of the area is given. Water surface area in this study was found to be 3.3 million acres and the volume of water was calculated as 23 million acre-feet. Stream discharge figures by monthly average from 1953 to 1967 are presented for nine major rivers and bayous in the study area. A brief description of private and public oyster leasing includes 1969 figures on acreage. Also briefly discussed are shore plant installation of commercial fisheries, problems of domestic and industrial waste, and certain aspects of navigation canals and filled and drained areas.

*Information in this section was extracted from data compiled for the Louisiana Wild Life and Fisheries Commission and the U.S. Department of Commerce, National Marine Fisheries Service (Public Law 88-309, Project 2-22-R). The data were published in 1971 in two volumes entitled "Cooperative Gulf of Mexico Estuarine Inventory and Study, Louisiana."

Hydrology (Phase II)

Samples were taken at 109 stations throughout the six study areas. Salinity and water temperatures were measured at all stations. Dissolved oxygen, turbidity, the nutrients--nitrate, nitrite, inorganic phosphates and total phosphorous were measured at 82 stations. This information is discussed by area and presented in tabular form. Data on air temperature, precipitation, and stages and discharge of principal rivers were collected. A table of surface water area by depth intervals encompasses a nine-area division of the coastal region.

Salinities were found to be highest during the fall and lowest during the peak river discharge. Water temperature was seasonal, closely following air temperatures. Dissolved oxygen concentrations were highest during periods of low water temperature and salinity. Turbidities generally fluctuated directly with river discharge and wind speed. The seasonal distribution of nutrients was generally irregular; however, nitrate values were highest at stations near the mouth of the Atchafalaya and Mississippi rivers during peak discharge periods.

Sedimentology (Phase III)

Between March, 1968 and June, 1970, sediment samples at 1,536 points were taken and the top three inches of the core sample were examined. Sampling was irregular in time; thus, cyclic (seasonal) changes in sediments were not determined. Data are assembled on the basis of the six estuarine study areas. For each sample point, percentages of clay, sand and silt are given. Statistics on particle sizes in each sample include mean, median, standard deviation, skew, a measure of asymmetry of size distribution curves, and kurtosis, which is a measure of peakedness of size distribution curves. Maps showing sediment types of water bottoms in the study areas are included.

For the most part, sediment in Louisiana's coastal waters was found to be similar. Peat, which results from decomposition of marsh grasses, is a major component of the marsh and water bottom.

Since most streams emptying into the coastal area are sluggish and do not carry sediment to these lower reaches, the sedimentologically dominant process is erosion. This

erosion contributes to the fine particles found in estuaries. The size of sediment particles was found to vary from coarse, near the Gulf of Mexico and barrier islands, to fine, in the upper estuarine areas.

Biology (Phase IV)

This part of the report consists of two separate segments-- (1) fishes and invertebrates and (2) zooplankton.

For the fishes and invertebrate study, 82 trawl stations and 12 seine stations were established. Trawl samples were collected monthly or biweekly and seine samples were collected monthly. The trawl samples were taken by towing a 16-foot seine 200 feet offshore parallel to the shoreline and pulling it ashore.

Data are presented in tabular form. One table shows the number of each species caught per average haul for each month in each study area. Another shows the numerical catch of certain more common species by temperature and salinity intervals.

Size range of the species is shown in this table. Some 100 species of fishes and 12 species of invertebrates were collected in a total of 1,390 trawls and 130 seine samples. Half of the fish species and seven of the invertebrate species were classified as commercial. Of all the species collected, 95 per cent were found to be estuarine-dependent, that is, generally the larvae, or juvenile, stage of the species life cycle is spent in an estuary. A brief description of each species caught is also given.

Data on commercial fisheries operation from 1930 to 1969 and the value of yearly catches of various species from 1962 through 1966 are presented.

Zooplankton studies were made at 28 stations. A total of 681 samples was taken from April, 1968 through March, 1969. Samples were collected by passing 100 cubic meters of water through a net just below the surface. The sample was allowed to settle; then, an aliquot of the sediment was examined by microscope and the number of each species per 100 meters of water in the filtered sample was calculated. Data are presented in three series of tables. One gives species composition and relative

abundance of major plankters in monthly plankton aliquots. The second series indicates gross distribution of plankton by temperatures and salinity intervals and the third shows, for each species, the distribution by temperature and salinity interval.

Results are discussed on the basis of each study area. Emphasis is placed on plankton level peaks and each of the species of plankton found is treated briefly.

The greatest concentration of plankton was found in study area III, which is between the mouths of Bayou Lafourche and Grand Bayou. The lowest concentrations were found just east of the Mississippi River and in study area VI from Vermilion Bay westward to the Louisiana-Texas line. A spring and fall maximum plankton concentration was found in all areas and, except at the mouth of the Mississippi River, the spring maximum was the greater of the two maximums. Ctenophoric were found to influence greatly the plankton levels. In all samples in which etemophores were abundant, zooplankton was low. (This might have been partially the result of net plugging, e.g., poor sampling.) During the study, "acartia tonsa" was found to be the dominant member of the zooplankton community.

APPENDIX ONE
Comprehensive Studies Affecting Louisiana's Coastal Zone

SECTION THREE
Proposed Multiuse Management Plan
for the Louisiana Coastal Zone*

- I. Introduction
- II. Approach
- III. The Plan
 - A. Barrier Island, Reef and Gulf Shore Areas
 - B. Estuarine Nursery Areas
 - C. Fresh-Brackish Marsh Areas
 - D. Freshwater Basins
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Figures

- A-1 The Louisiana Coastal Area
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- A-3 Configuration of Proposed Man-made Barrier Islands

*Prepared for presentation to the Louisiana Advisory Commission on Coastal and Marine Resources in December, 1972, and revised in July, 1973. Prepared by Coastal Resources Unit, Center for Wetland Resources, Louisiana State University, Baton Rouge. Project Director, Sherwood M. Gagliano; staff, Penny Culley, Daniel Earle, Jr., Curtis Latiolais, Phillip Light, Nancy Roques, Alice Rowland, Roy Shlemon, Johannes L. van Beek.

This section is presented for its information value to readers of this report. It was not adopted as a recommendation of this Commission. However, the work of Dr. Gagliano and his colleagues has been extremely helpful to the Commission in formulating its recommendations. His work is cited in many places throughout this report.

Introduction

In early 1969, the Coastal Resources Unit adopted as its major research objective the development of a management plan for the Louisiana coastal zone (Fig. A1). Through a series of contracts with the New Orleans District, U.S. Army Corps of Engineers, the NOAA Office of Sea Grant, the Louisiana Wild Life and Fisheries Commission and the State Mineral Board, steady progress toward the objective has been made. Although none of the contracts specifically authorized the development of a management plan for the entire coastal zone, each contract has involved tasks related to environmental setting or resource management and land use.

Funding of projects which have contributed directly to the study during this three-year period totaled \$416,953. In addition, invaluable data have been contributed by projects of the Office of Sea Grant Development and the Coastal Studies Institute.

The studies have progressed through several distinct stages:

- 1) Review of natural processes and forms and synthesis of quantitative data
 - a) Geological, ecological
 - b) Hydrology and water chemistry (salinity, temperature, sediment load, discharge)
 - c) Water balance - runoff studies
- 2) Problem definition
 - a) Land loss
 - b) Saltwater intrusion
 - c) Canals, dredging, land reclamation
- 3) Development of management plan and "creative" approaches
 - a) Land use recommendations
 - b) Dynamic Management: (water chemistry, levels, regimes and controlled delta building)
 - c) Use of salt domes
 - d) Corridors
 - e) Barrier Islands

Results of the individual control studies have been documented in a series of technical reports and journal articles, listed at the end of this paper. These reports provide much of the basic data upon which the plan presented herein is derived.

As the title implies, the plan is proposed as an approach to multiuse development of the coastal zone resources that will provide for both growth and development of the area's

population and economy, management and use of those renewable and irreplaceable resources which are vital to the nation, the state and the quality of life of the region's inhabitants.

Approach

Throughout the many studies that have led to projection of a management plan for the coastal zone, there has been a focus on the development of a methodology for environmental evaluation. Proceeding from the assumption that the best basis of projection is a sound understanding of the area that is to be planned, scientific processes and knowledge have been applied to meeting immediate and practical needs. The subject area of environmental evaluation has progressed tremendously in the past few years and using environmental data to plan is now a well accepted technique. The approach recognizes that Louisiana's coastal zone is unique in both natural landscape and cultural processes and it uses these inherent qualities and values as a basis of projection.

The natural setting of the coastal zone of Louisiana can be summed up in one word, "dynamic." It is one of the most rapidly evolving areas of the world. This creates some problems, but at the same time offers many opportunities. The coast is the product of the delta-alluvial system of the Mississippi River in contact with the marine forces of the Gulf. The landscape forms--the natural levees, the fresh water swamps and marshes, the brackish marshes of the coast, the terrace and prairie lands, the bayous and water courses, and the coastline of offshore islands--all are in a changing and constantly evolving relationship.

Changes are often so rapid and seemingly so complex that one might view them as random and unpredictable, but that is not the case. Over the years (based on our studies of coastal wetlands) we have developed a good understanding of the form and process relationships that exist in the coastal area. It is now possible to predict with a high probability the effect of any major modification upon the environment. It is this prediction capability that permits the development and selection of possible alternatives for the future use and management of our resources.

The inherent values of the coastal zone are many and varied, and it is the retention and development of these values that makes planning essential. The economic values of the coastal zone have been well documented. For example, oil and other mineral extraction industries, commercial fisheries, harvesting of fur animals, and the high recreation value of the coastal zone are self-evident. Major cities,

dependent upon connection to the Gulf and inland areas, have developed at high land points or on the fringes of the wetland areas. Of no less value, the coastal zone is rich in scenic, historic and recreational resources. Other renewable resource values include storage of surface and ground water, and wildlife habitats, a buffer zone for air and water pollution and storm surge.

The history of man's occupation of Louisiana's coastal area has indeed been quite long, which testifies to its past and current values as a living environment. Man's presence in the area has been documented back 12,000 years and there is evidence of more or less continuous use since that time. Early European settlers and more modern civilizations have tended to make extensive and often wise use of the land as they settled, farmed, developed the levee lands, and fished and hunted in the wetlands. Road and water transportation has long played a major role in development of the region and is an essential component. In more recent times, as man has tried to overcome the hazards of floods and storms, and as extraction of subsurface minerals and use of other resources has become more pressing, the environmental base now shows signs of serious, perhaps irreversible stress. There is a real danger that many of the values traditionally cherished by the people are being threatened or lost through environmental and cultural pressures. The prime basis of a coastal zone management plan is to achieve a compatible relationship between the land base and the needs of people, one which will be mutually beneficial, now and in the future.

In concept, the plan recognizes environmental opportunities and constraints. It recognizes that man must make adaptations of the environment for his successful use and occupation of the land. It points out that man must use restraint in manipulating the environment if it is to continue returning long-term values to him. Man is a user and a steward of the land.

The plan for the coastal zone is based upon two major concepts. The first is a corridor-basin relationship. Within the coastal zone are two broad, natural land systems, the natural and protected levee ridges where historically human settlement has taken place, and the wetlands that throughout history have been the major renewable resource base of the state. The plan recognizes the value of this physiographic and historic pattern and emphasizes the levee systems as sites for transportation and development corridors with conservation of the wetlands as water system recharge and natural resource development areas.

The second concept recognizes the need for successive and changing land use in an orderly sequential manner. This is necessitated by the dynamic nature of the natural systems of

the coastal zone. We must recognize and accommodate natural changes by modifying land use through time. The system cannot be held in a static condition. The old engineering dream of "harnessing the river" will surely destroy the viability of the Louisiana coastal zone.

The concept of sequential use can be extended to man's activities. Facilities for mineral extraction, industrial plants and certain public works projects have a limited life expectancy. When such facilities are designed, an attempt to predict some future land use of the site should be made to avoid irreversible environmental modifications that are not compatible with predicted future use.

The Plan

The proposed management plan (Fig. A2) is based on major natural and cultural elements of the coastal zone landscape. It presents a broad-brush proposal for management and development of the Louisiana coastal zone. Boundaries between units are drawn from natural features, ranking of environmental opportunities and constraints, and from historic and projected land use patterns.

Barrier Island, Reef and Gulf Shore Areas

These features represent the first line of defense against hurricane forces and marine processes. Tidal inlets and streams associated with the islands, reefs and Gulf shore are the control valves of the estuaries, regulating inflow and outflow of Gulf water. The islands are invaluable as wildlife habitats and scenic-recreation areas. These features are undergoing rapid changes as a result of coastal erosion, accelerated regional subsidence, and hurricane damage. For example, large shell reefs in the vicinity of Atchafalaya Bay and Marsh Island lie within areas leased for shell dredging and soon may be destroyed. Canal dredging on the bay side of a number of the islands for oil rig locations and pipelines has seriously increased their vulnerability to storm surge damage.

Grand Isle, the most stable of the Louisiana barrier islands, is accessible by highway and is important as a recreation area, as a base for the offshore oil industry and as a fishing port. Frequent hurricanes and coastal erosion are a continuous threat to life and property on the island. Similar permanent development of other barriers should be discouraged.

It is recommended that top priority be placed on management of these units as natural barriers against storms and marine forces (including tidal inflow and outflow of Gulf water) and as wildlife and scenic-recreation areas. Their maintenance

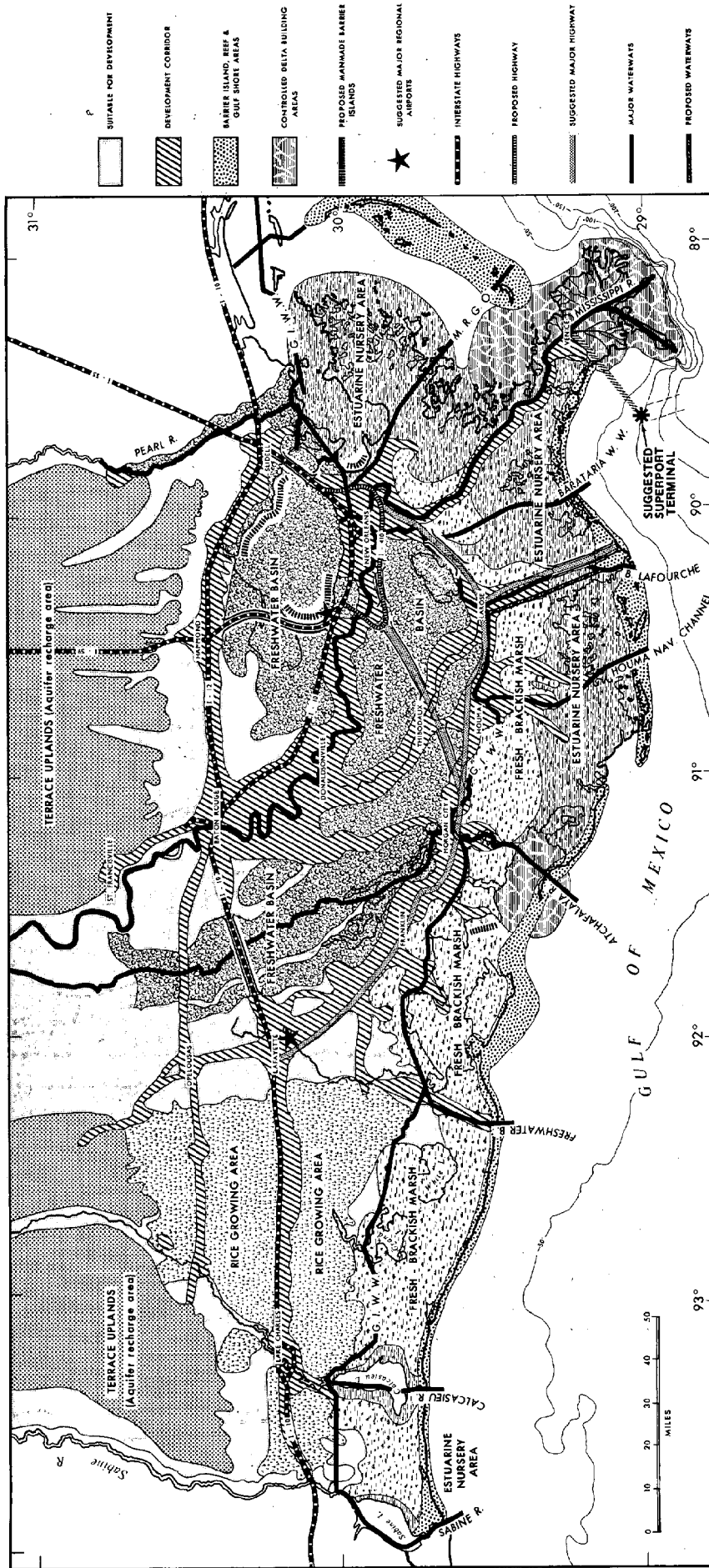


Fig. A2 PROPOSED MULTIUSE MANAGEMENT PLAN FOR THE LOUISIANA COASTAL ZONE

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is vital to the continuing viability of the natural systems in the coastal zone. Detailed studies of erosion and deterioration should be initiated immediately in order to implement restoration and management. The islands are so vital to the future of the coastal zone that they should be in public ownership.

Estuarine Nursery Areas

From the standpoint of biological productivity, the estuaries represent the most productive acreage in the state. Not only are they the foundation of the state's fishing industry, but they provide important habitats for migratory waterfowl, fur bearing animals and reptiles, and are important scenic-recreation-open space areas. The units are defined on the basis of distributions of salinity, marsh vegetation, oyster beds and length of land-water interface per unit area.

These areas should never be drained or reclaimed for other uses, not even agriculture. Recent overflights indicate that thousands of acres of marsh in the estuarine nursery areas are in an advance state of deterioration. Programs of marsh restoration and management should have the highest priority and should be initiated immediately. Such programs should include a detailed systematic evaluation of the marsh condition followed by a water management program designed to conserve runoff, reduce saltwater intrusion and curtail erosion.

Although the map is intended to be a clear statement that the primary management objective in these units is for renewable resources, we also recognize that mineral extraction industries are active in these areas. If it becomes necessary to drill new wells, develop new fields or lay new pipelines, the surface modification associated with these activities must be made compatible with the primary management objective.

The concept of sequential use is also important. Since an oil field has a life expectancy of 35 to 70 years, we must plan for future use of areas now occupied by fields. In many instances, creative planning of canal geometry and spoil disposal could create new habitats, conserve freshwater runoff and enhance the environmental setting. In general, canal dredging should be minimized. Directional drilling should be used to reduce the number of well locations, and pipelines should be confined to corridors. Surface features should be considered in all future mineral industry planning. These same guidelines apply to extraction industry activities in all of the renewable resource management areas, and will not be repeated.

Fresh-Brackish Marsh Areas

Largely unbroken fresh to brackish marshes and associated lakes, ponds, and waterways occupy a major portion of the estuarine zone south of the Gulf Intracoastal Waterway (GIWW). They are delineated on the basis of distributions of salinity, fauna and flora, configuration of streams and water bodies, and length of water interface per unit area. Like the estuarine nursery areas, these marshes are vital components of the highly productive estuarine zone. They are of primary importance to migratory waterfowl, fur-bearing animals and commercial species of reptiles (alligators). They provide scenic open space recreation areas and are of considerable value to the commercial fishery. In addition, these marshes, along with other renewable resource areas located south of the GIWW, provide a critical buffer zone against storm generated surge and prevent serious inundation of inland communities. With regard to land-use, it should be pointed out that in these units thick underlying deposits of peats and soft clays provide poor foundation conditions.

Priorities and management recommendations are essentially the same as those outlined for the estuarine nursery areas.

Freshwater Basins

Four major freshwater basins are identified on the map. All lie north of the GIWW. They are dominated by extensive swamps and marshes, rounded lakes and sluggish backswamp drainage networks. They are usually underlain by thick deposits of peat and organic clay, which provide very poor foundation conditions and limit land use. Their value as wildlife habitat areas is well known not only to the sportsmen and naturalists of the region, but to a large segment of the general public as well. These basins are also important as natural reservoirs ensuring freshwater flow into the estuarine zone south of the GIWW throughout the year. This fresh water influx is one of the primary factors in controlling estuarine water chemistry. Alteration of the flow regime in some of these basins through drainage projects, canal dredging, flood control projects, and highway embankments is presently one of the major factors in increased saltwater intrusion in the estuaries.

These basins must be managed as renewable resource areas. Forestry, fisheries, and recreation are the main uses recommended. Dredging should be minimized, and draining and reclamation prohibited. In most instances, highways traversing the basin should be elevated on piers or piles. In general, introduction of any new linear elements should be discouraged. If unavoidable they should be confined to corridors parallel to existing highways, pipelines, etc. Water storage in the basins should be managed in order to optimize water chemistry in the estuaries to the south.

Existing corridors through these basins should be de-emphasized from the standpoint of development. For example, U.S. Highway 90 between Boutte and Raceland is an important transportation link, but should not be encouraged as a development corridor. Access along such highways should be restricted.

Guidelines pertaining to the mineral extraction industries are essentially the same as those proposed for estuarine nursery areas. In addition, construction of tramways or roadway embankments in inland swamps and marshes should be minimized. Such features often redirect freshwater runoff in the basins and provide obstacles to the movement of aquatic and terrestrial animals.

Areas Suitable for Development

In general, areas suitable for development are those places that have good foundation conditions, good drainage, and are reasonably safe from flooding. Pleistocene terraces, salt dome islands, and natural levee ridges form the higher, positive topographic elements in the Louisiana coastal zone that are designated as suitable for development. Historically, agriculture, industry and settlement have been largely restricted to these areas. Attempts to extend these activities into adjacent wetlands have often proved to be catastrophic.

The key to proper land use is careful planning. A good mixture of urbanization, industry, and agriculture in these areas will insure both orderly growth and economic development and a good place for people to work and live. Soil and meteorologic conditions should be mapped in detail and suitability for agriculture ranked. Prime agriculture areas should be identified and promoted in every way possible. The rich rice growing region of southwestern Louisiana, for example, should be maintained primarily for agricultural use.

Development Corridors

Corridors constitute major elements in the proposed multiuse management plan. They represent areas that are already heavily developed or where development is projected. In most cases, corridors are confined to land surfaces suitable for development. In some instances however, "natural" corridors have been expanded to boundaries formed by prominent man-made features such as major navigation canals or flood protection levees. For this reason, some of the land included within the development corridors has poor foundation conditions and is flood prone. The rationale for expanding some natural corridors is to provide adequate area for development so that random extension into renewable resource areas can be controlled.

In addition to land suitability, locations of development corridors are dictated by major land and water transportation arteries, historic land use patterns, and the necessity to maintain rather than dissect existing natural entities. The term development corridor is not to imply blanket urbanization or industrialization. Creative planning is again recommended to insure the best mix of land use.

Public works projects should be focused on the corridors to strengthen and further define them. Highways, flood protection levees and structures, drainage projects, should be incorporated into the corridor plan. Such projects should be combined wherever possible to minimize land acquisition and costs. There is no reason, for example, why highways cannot be constructed on the crests of levees. This is a standard procedure in the Netherlands and many other parts of the world. Water resource management, mass transit systems, and regional waste collection treatment systems should likewise be incorporated into the corridors. Linear elements such as pipelines, power lines, should be confined to the corridors.

The contact between corridors and intervening renewable resource management areas presents an interesting challenge to the planner. Should it be smooth or crenulated? Should access between development corridors and marshes or swamps be linear or nodal? Only detailed environmental analysis can provide the answer to these specific planning and design decisions.

In some instances the continuity of a development corridor depends on a transportation link across a wetland area. A classic example occurs between Lafitte and Larose. We believe that a transportation link between these two places is important to orderly development of the coastal zone. It is also recognized that excessive development across this area is likely to cause serious deterioration of the rich Salvador-Barataria estuary system. In these instances, we propose, therefore, that future highways be elevated on structures with permanent restrictions against off ramps. This same principle can be applied in a number of critical areas; notably in the St. Charles Parish wetlands along the south shore of Lake Pontchartrain where I-10 and I-410 will join, and along the Atchafalaya Basin crossing of I-10.

Geometry for Development

The development corridors shown on the plan represent an excellent geometry for future growth and development of the coastal zone that is compatible with management of renewable resource areas. The great oval linking Lafayette, Baton Rouge, Hammond, Slidell, New Orleans, Larose, Houma, Morgan City, and Franklin is one of the most basic elements in the orderly

use of the coastal zone. Reinforcement of this oval-shaped corridor should have highest priority. The southern Lafayette-Houma-Slidell arc is of particular importance. Improved transportation along this arc would provide easy ingress and egress to the coastal zone making its opportunities available without necessitating over population. Urbanization should be encouraged on the well-drained surfaces near the eastern and western poles of the oval. The Slidell-Hammond-Baton Rouge area and the Opelousas-Lafayette-New Iberia area satisfy most of the site requirements for good urban development. Much of the southern arc is also suitable for urbanization, but on a somewhat reduced scale. The Thibodaux-Houma area, for example, would eminently provide for urban growth. The channels and natural levee ridges of the Mississippi River and Bayou Lafourche represent major transcoastal development corridors and the state's most important gateways to the Gulf. The Mississippi River corridor should be reinforced; although, it must be asked what its capacity is. Is there a limit to industrialization in this corridor or can every acre of the natural levee be utilized? The banks of the Mississippi River already are lined with industry and many additional plants are anticipated. Air and water pollution are an inevitable consequence of this industrialization. To what extent can the natural system absorb even a minimum of pollutants?

Despite these unknowns, the Mississippi River is, and will continue to be, the state's most valuable asset. Its channel should be improved to a navigation depth of 55 feet. The lower end of the Mississippi corridor should be reinforced. Venice is destined to become an even more important support facility for the offshore oil and gas industry and future superport development.

The geometry of the development corridors and of the environmental management units lends itself to evaluation of proposals for both a deep water port (superport) and regional air carrier terminals. If the decision is made to construct a superport terminal along the Louisiana coast, (there is still considerable doubt whether the natural systems of the area can absorb the total primary and secondary impact of such a development and whether it would be in the best interest of the people of the state) present data indicates that the best location would be in the Gulf southwest of Venice, La. (see Fig. A-2). Southwest Pass, Tiger Pass and the Empire Channel would provide initial access to the oil terminal site. As later stages of the facility develop, which may include containerized and break-bulk cargo handling, a 55-foot navigation canal and control lock should be constructed to link the superport with the Mississippi River at Venice. If this location were utilized, all auxiliary development could be confined to a relatively small area in the lower delta and to the Mississippi corridor.

The Lafourche corridor should be reinforced with improved highways and flood protection. However, flood protection levees should not be extended south of Golden Meadow. The proposed Lafourche Auxiliary Channel would define the western margin of an expanded natural corridor to Golden Meadow, and an upgraded limited access highway would provide a link to the recreation resources of the Gulf shore.

Although old beach ridges near the mouth of Bayou Lafourche offer good foundation opportunities, recent studies of this area suggest that its best use would be for recreation and open space. The Grand Terre to Isle Dernieres segment of the coast represents Louisiana's most important recreation outlet to the Gulf shore. In addition, the estuaries associated with this segment of the coast account for a high percentage of the state's fisheries harvest and are among the most productive estuaries in the world. A critical evaluation of an earlier proposal for a superport terminal offshore from Bayou Lafourche with onshore facilities at Port Fourchon has led to the conclusion that this location would be highly impractical. It would be folly to introduce a major commercial-industrial intrusion into an area of such high recreation and renewable resource value.

Minor transcoastal corridors include Bayou Terre aux Boeufs, Bayou Petite Caillou, Bayou du Large, the Atchafalaya River, Bayou Sale, Bayou Cypremont, Fresh Water Bayou, the Calcasieu River, and the Sabine River. Each of these corridors will play an important role as outlets for recreation, the fishing industry, the offshore mineral industry and to some extent, as outlets for commercial ports. However, further widening and deepening of associated navigation channels is discouraged because of the saltwater intrusion problem. The roles of other minor development corridors in the upper coastal zone are apparent from their location and form.

If surface transportation in the corridors is improved as suggested, two major airports should be adequate for serving the region. A long-term plan for gradual upgrading of the Lafayette Airport would accommodate the western half of the corridor network. Locating an airport to serve the eastern half of the corridor oval is more challenging. If it is not feasible to upgrade and enlarge Moisant International Airport, a new facility should be constructed in the vicinity of the intersection of I-10 and I-55 near Laplace, La. The site should be on the natural levee ridge of the Mississippi River if at all possible. The Bonnet Carre Floodway should be investigated as a potential site. However, if the floodway lands are used for this

purpose, an equal acreage of adjacent wetlands should be purchased as a recreation area. The airport should not be built in the swamps south of Lake Maurepas because of exceptionally poor foundation conditions and the value of these wetlands for open space and recreation. A proposed airport location in the eastern end of Lake Pontchartrain is a poor choice for similar reasons.

There is presently a rash of proposals for new towns and harbor towns in the coastal zone. A number of these proposals involve the use of public lands or require government assistance in the form of flood protection, drainage, access roads and other aspects of site preparation. A number of the proposals would involve significant loss of wetlands and create major water pollution problems. There are many excellent sites for new towns within the development corridors and those areas suitable for development. The consumer will pay heavy penalties in increased site preparation, maintenance costs and tax burdens for any urbanization or development in wetland areas of the coastal zone. All wetland reclamation, including "Florida type" canal and homesite developments, for urbanization should be prohibited.

The new community concept is an excellent one. New towns properly placed within development corridors would guarantee a more orderly growth of the region. A limited number of harbor towns at carefully selected locations would also be a major asset. However, the locations should be pre-determined by the geography and hydrology of the region and not simply by the wishes of land developers. Since harbor towns can have major environmental impact, additional study is recommended to determine favorable locations and sizes.

Environmental Engineering

When coastal Louisiana was in a virgin condition, nature did a superb job of environmental management. Balanced environmental conditions resulted in high biological productivity and, in general, the system was self-maintaining. Erosion occurred along some parts of the coast, but this was more than compensated for by new land built in the vicinity of the active outlets of the river.

Man's impact has caused serious imbalance in the systems. One symptom is massive marsh deterioration and land loss. Land in the coastal area is being lost at a staggering rate of 16.5 mi^2 per year and a 30 year loss of almost 500 mi^2 has been measured. It is not an exaggeration to say that the delta is dying.

We must restore the delta and manage it to optimize natural productivity. This can be achieved by directing natural processes. For example, the freshwater outflow and transported sediment load represent a tremendous amount of energy and supply of materials. The delta has literally been constructed by this energy source and material supply. By redirecting flow and helping the river to initiate new cycles of delta building, new marshlands and estuaries can be built. Prime areas for these activities are designed as controlled delta building areas on the map. Our studies indicate that the Atchafalaya has been building a marine delta lobe since about 1950 and, if not interrupted, some 100 mile² or more of new marshland will have been added to the coast by about the year 2000. Similarly, for relatively small investments of flow and sediment, very large areas of land could be constructed along the lower Mississippi River in relatively short periods of time (30 to 50 years).

Our work has also documented a need for supplementary freshwater for estuarine management. Supplementary water introduced through control structures from the Mississippi and Atchafalaya rivers into the estuaries could be used to optimize salinity conditions and restore a more favorable balance in these systems. A comprehensive surface water management plan is now being developed for south central Louisiana (Terrebonne-Barataria area) and will be presented in a forthcoming report.

Erosion control is fundamental in the coastal zone, but it is especially challenging as there are over 30,000 miles of land-water interface south of the GIWW and much of it is eroding. Preservation of the barrier islands and other sandy Gulf beaches depends on recognition of their dynamic nature. Longshore drift of sand must not be disrupted by channels, jetties or groins. Sand source areas which provide nourishment to the drift system must also be protected. Dredging on or in the vicinity of barrier islands must be prohibited. The Louisiana barrier islands are in a very delicate natural balance, at best. Further disruption of that balance will only accelerate their demise.

One approach to erosion control along the muddy shorelines of large lakes and bays would be the construction of barrier islands. As shown in Figure A3, the islands typically would be one fourth to one half mile in length and separated from the shore by a shallow lagoon. Passes would be left between individual islands. The islands would be constructed around a rigid structural core of interlocking metal sheet piles, concrete tetrahedrons, or some similar rigid skeletal material. The body of the islands would be composed of lake or bay bottom sediment supplied by suction dredges or large drag lines. The seaward edge of the islands would be veneered with gravel,

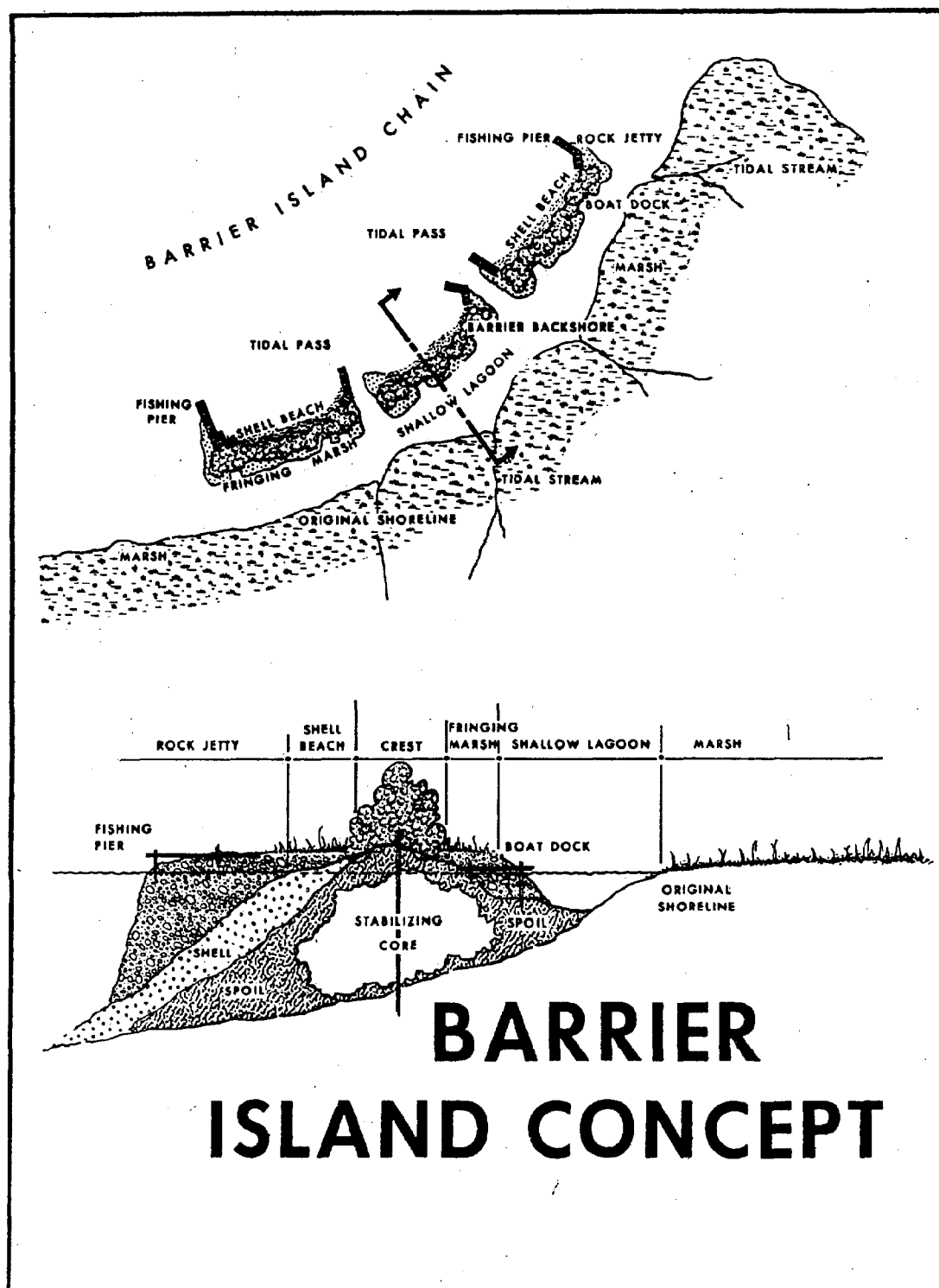


Figure A 3 Configuration of proposed man-made barrier islands.

shell, sand, or some other coarse grained material that would absorb wave energy. The (tidal) passes would be lined with rip-rap or some other rigid, erosion resistant material. A soft edge would be left on the lagoon side of the islands and would be planted with marsh grass.

Although this type of erosion protection would be relatively expensive, it has a number of important advantages. Islands would not only prevent erosion, but would also reduce storm surge without destroying the important natural land-water interface along the estuary margin. Marshes and swamps could be maintained in a natural condition landward of the lagoons. The islands would not only reduce significantly the erosion problem without damaging the estuary, but would actually enhance the total environment.

Island construction would create new, more diversified habitats. These would include beaches, vegetated island crests, lagoon fringing marshes, tidal passes and lagoons. Increased recreation opportunities resulting from this approach are particularly attractive. The beaches and passes would be ideal for (surf) fishing and other water contact recreation. Island backslopes and crests provide picnic areas and camp sites, and lagoons could function as small boat shelters. The new natural environments could also provide for wildlife and fish habitats. These would include lagoons for oyster beds, passes for fin fish and crustaceans, fringing marshes and lagoons as estuarine nursery areas and habitat for migratory waterfowl, fringing marshes and regulated island crests as mammal and reptile habitats, and beaches, passes and island crests as habitats for shore and wading birds.

As shown on the map, man-made barrier islands should be constructed on the margins of large lakes and bays in places where the wetlands are of high value for recreation and/or as estuarine nursery areas and wildlife habitat. A typical application would be along the western margin of Lake Borgne, where erosion is not only destroying valuable marshes, but also is destroying a number of historic and archeological sites.

The barrier islands illustrate an important concept of environmental engineering. That is, if energy and resources must be expended to solve a problem, it is often possible to reap additional benefits by creative planning. Subtle changes in elevation and geometry alter natural processes to create favorable opportunities for desirable fauna and flora. The same approach could be applied to the geometry of oil field canals and spoil disposal sites that might result in environmental enhancement instead of deterioration for the same expenditure of energy and resources.

There are several unique features in coastal Louisiana that may be of considerable value in solving problems of regional waste collection and treatment. As previously mentioned, regional sewage collection systems should be confined to development corridors. Urban sewage has some nutrient value to the estuary system if bacteria can be eliminated. Pilot studies of marsh enrichment are presently in the planning stage.

As shown on the map, aquifer recharge areas of the Terrace Uplands are in relatively close proximity to coastal urban centers. Using these areas and the seaward sloping aquifers that they supply, soil filtration of sewage may be highly feasible in south Louisiana.

Another approach, currently under investigation by the CRU research group, involves use of large solution cavities in subsurface salt domes as reaction chambers for generating methane gas and other usable byproducts. Man-made solution cavities in salt domes are presently used on an operational basis for storage of liquid propane. We propose that raw sewage could be introduced into such cavities where, with the introduction of selected catalysts and temperature control, gas generating reactions might occur.

Although rapid transit does not fit comfortably within the category of environmental engineering, it is viewed as an important consideration in future development and management of the coastal zone. The proposed development corridor geometry lends itself well to application of rapid transit systems. It would provide one means of allowing people to work, use, and recreate in the lower coastal zone without destroying it by over population. In this region, the very large capital outlay required for design and construction of a rapid transit system and even subsidy for operation might be justified in terms of renewable resource savings.

Although an in-depth discussion of navigation channels is beyond the scope of this paper, a few specific comments may be in order. It is recommended that a 55-foot deep navigation channel be constructed from the Mississippi River southwest to the Gulf in the vicinity of the Jump at Venice. A major lock that would accommodate ocean-going vessels should be included in the project. Although initial costs would be very high, major benefits would accrue from the project. The channel would bypass the shoal areas associated with the mouths and lower reaches of South and Southwest Passes. The lock would greatly reduce the costs of maintenance dredging and alleviate the threat of saltwater intrusion during low river stage. The channel

would provide a link between the Mississippi and the recommended superport site. If this channel and lock were constructed, maintenance of Southwest Pass for navigation could be discontinued, representing a considerable cost savings. Further, this closure would release approximately 30 per cent of the lower river's discharge and flow for environmental management purposes. This water and sediment could then be used for controlled delta building. The project would have both economic and environmental benefits.

In general, widening and deepening of natural channels and dredging of canals from the Gulf inland creates serious environmental problems. Saltwater intrusion, accelerated runoff and increased tidal exchange accelerate marsh and swamp deterioration and erosion. In this regard, the Mississippi River Gulf Outlet (MRGO) has had catastrophic environmental effects. The channel has greatly accelerated deterioration of what was once one of the state's most productive estuary areas. Economically, the project has been a failure. It was originally constructed as a short-cut for ocean going vessels between the Gulf and the Port of New Orleans. Because the channel is narrow (500 feet) and shallow (35 feet) and prone to shoaling as a result of massive bank failure, it is little used. Only a small fraction of ocean-going traffic uses the channel. Primarily because of the unstable banks, maintenance costs have been exceptionally high--averaging \$3.9 million per year. Because of these reasons and because the Mississippi River can and will continue to serve the navigation needs of New Orleans, Baton Rouge and other river ports, it is recommended that maintenance of MRGO for ocean-going vessels be discontinued.

Proposals to improve navigation in the lower Atchafalaya (Atchafalaya River and Bayous Chene, Boeuf, and Black Project) have serious environmental considerations. Little consideration has been given to the impact that this channel would have on delta building processes presently occurring in the bay. This project should not be implemented until the environmental impact is thoroughly understood.

Implementation

Obviously, the implications of the proposed plan are far reaching. Although some landowners, many communities and the state and the nation in general would benefit from the plan, implementation would undoubtedly impose financial and social hardships on a considerable number of individuals. The emphasis of our studies has been on the environment and suitability of the landscape for certain uses. Although not considered here, social, economic, engineering, and legal considerations are equally important.

The necessary legislation and authority to partially implement such a plan may be already in effect. Large public works projects can be used to reinforce development corridors and to direct growth into suitable areas. Without indirect subsidy in the form of highways, flood protection and drainage, wetland reclamation usually is not economically feasible. Further documentation of the value of renewable resources and consumer penalties associated with misuse of wetland areas will strengthen this argument.

It is fully recognized that private land owners must be compensated for loss of property rights and revenues, or for participation in environmental management programs. This has been done in other states through tax reliefs, scenic and use easements, and direct lease. Public acquisition is recommended for the most important renewable resource areas, and unique environmental and cultural features.

A continuing program of environmental and land use research, and public education is vital. Systematic ranking and evaluation of our resources and a public awareness of their value will insure responsible decisions from elected and appointed public officials. It is essential that the state and local areas gain control of their destinies. Decisions that may result in the deterioration of the environment and the quality of life of coastal zone citizens cannot be made in distant corporation board rooms or administrative offices.

We must learn more about the capacity of the region to absorb increases in population and industry. The natural systems already exhibit clear signs of imbalance. Rigid control standards must be imposed on industry. New industry must be compatible with the environmental setting.

Historic studies document that random, unplanned development in the coastal zone results in environmental destruction by attrition. Although impact of individual actions may seem insignificant, the cumulative effects are often of catastrophic proportions. For the past 30 years, the natural environment of the Louisiana coastal zone has seriously deteriorated as a result of the impact of growth and development. The deterioration is accelerating at an alarming rate. These historic changes are documented and can be measured and future changes, if controls are not imposed, can be predicted with a high degree of probability.

The plan presented here can be compared to a single photographic frame in a very long motion picture. It represents one step in a long and continuous process. It should be modified and changed as our understanding of the

natural setting of the coastal zone increases and our ability to analyze human processes is sharpened. However, we believe that it does represent a specific point of departure and a geometry that will allow for an orderly increase in population and use of the resources of the region for continued economic growth without destroying those aspects of the region which are so fundamental to the quality of life of the people who reside there.

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Coastal Resources Unit

CENTER FOR WETLAND RESOURCES
Louisiana State University
Baton Rouge, LA 70803

Reports done under U.S. Army Corps of Engineers contract Nos. DACW 29-69-C-0092, DACW 29-70-C-0272, and DACW 29-71-C-0219 constitute a series titled "Hydrologic and Geologic Studies of Coastal Louisiana."

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APPENDIX TWO

A LISTING OF PROJECTS IN THE COASTAL ZONE BY CONSTRUCTION AGENCY

U. S. Army Corps of Engineers

Basically, Corps of Engineers projects fall into three categories: The first includes projects under general investigation. Such projects are awaiting authorization and are subject to general feasibility studies, i.e., general investigation. The second group consists of projects under construction. This category includes engineering design in addition to construction. The third category is for projects which the Corps of Engineers maintains. For example, periodically it is necessary to dredge most navigation channels to maintain specified depth.

Following is a listing of projects now subject to general investigation followed by a description of the study.

Barataria Bay Waterway

Determine feasibility of a navigational channel from Barataria Bay Waterway in the vicinity of Lafitte to the Gulf Intracoastal Waterway.(1)

Bayous LaLoutre, St. Malo and Yscloskey

Determine advisability of extending navigational channel 1,500 feet in Bayou LaLoutre from Bayou Yscloskey.(2)

Gulf Intracoastal Waterway - Highway Crossings

Study of needs of coastal area for high-level crossings of the Gulf Intracoastal Waterway at 10 locations.(3)

Mermentau, Vermilion and Calcasieu Rivers and Bayou Teche

Determine need for improvement to existing flood control, navigation, water supply and quality control facilities with respect to recreation, wildlife and related water and land resources.(4)

Mississippi River - Gulf Outlet

Determination of the feasibility of providing a larger channel in the Mississippi River - Gulf Outlet.

The following projects are in the construction phase:

Atchafalaya River, Bayous Chene, Boeuf and Black

This waterway will afford transporation for large offshore drilling equipment being built in the area for offshore drilling operations. Authorized by the Rivers and Harbors Act of 1968, this project will consist of a 20-foot by 400-foot channel from the vicinity of the U.S. Highway 90 bridge at Bayou Boeuf through Gulf Intracoastal Waterway, Bayou Chene, the Avoca Island Cutoff Bayou Drainage Canal, and lower Atchafalaya River, across Atchafalaya Bay to the 20-foot contour in the Gulf of Mexico.

Estimated cost of the project is \$12.14 million, which includes \$1.19 million in nonfederal funding. Preconstruction planning was completed in 1972. Construction is scheduled to start in 1973.(6)

Bayou Lafourche and Lafourche-Jump Waterway

Offshore operations and commercial fishing will benefit from this project. The auxiliary channel will help alleviate navigational hazards along Bayou Lafourche. Initial features of the project were authorized in 1935 and modified in 1960. That portion of the existing project on Bayou Lafourche, between Thibodaux and Donaldsonville, has been deauthorized under Public Law 90-149, approved in November of 1967. Work between Thibodaux and Lockport has been postponed because acceptable rights-of-way and spoil disposal have not been obtained by local interests.(7)

The scope of the project includes a 12-foot by 125-foot auxiliary channel on the west side of Bayou Lafourche from the

Gulf Intracoastal Waterway in the vicinity of LaRose, intersecting with Bayou Lafourche south of Leeville. A second part is a 12-foot by 125-foot channel from Bayou Lafourche at Leeville through Bayou Rigaud and Caminada Bay to the north side of Grand Isle.(8)

The auxiliary canal is still in the planning stage. It is estimated that the project as modified will cost \$10.44 million, of which \$3.12 million is to be supplied from non-federal sources.(9)

Mississippi River - Gulf Outlet, Michoud Canal

The Michoud Canal improvements will result in transportation savings to industries on the Michoud Canal. This project was authorized by the Rivers and Harbors Act of 1968. A 36-foot by 250-foot channel will be dredged along the present alignment of the Gulf Intracoastal Waterway from the Mississippi River Gulf Outlet through Michoud Canal to a turning basin at the head of the canal.(10)

Estimated cost of the project is \$1.69 million, of which \$63,000 is to be obtained from nonfederal sources. The project is still in the planning stage.(11)

Vermilion Lock

The present Vermilion lock, with a depth over the sill of 11.3 feet below mean low Gulf elevation, has become a hinderance to navigation. A replacement lock was approved by the Secretary of the Army in May, 1967, under authority granted by the Rivers and Harbors Act of May, 1909. The lock will be just west of the existing facility and will be 75 feet by 15 feet over the sill at mean low Gulf elevation.

Estimated cost of replacement is \$7.36 million, of which \$7,000 is to be nonfederal funds. The project is currently in the engineering design stage.(12).

The following projects are being maintained currently by the U.S. Army Corps of Engineers, with an expenditure in excess of \$400,000 planned in fiscal 1974. In descriptions, dimensions are in terms of depth and feet, in that order:

Atchafalaya River, Morgan City to Gulf of Mexico

A 20-foot by 200-foot channel about 16 miles long, terminating at the 20-foot contour in Atchafalaya Bay.(13)

Barataria Bay Waterway

A 12-foot by 125-foot channel about 37 miles long from the Gulf Intracoastal Waterway to the 12-foot contour in the Gulf of Mexico beyond Barataria Pass is maintained.(14)

Calcasieu River and Pass

This project includes a 40-foot long by 400-foot channel from the Gulf of Mexico to Lake Charles running about 35 miles, and a turning basin at the upper end.(15)

Fresh Water Bayou

This project consists of a 12-foot by 125-foot waterway between the Gulf Intracoastal Waterway in the vicinity of the Vermilion River, and a lock in the vicinity of Beef Ridge near the Gulf of Mexico. The channel is maintained to the 6-foot contour in the Gulf.(16)

Gulf Intracoastal Waterway, New Orleans District

The Gulf Intracoastal Waterway, New Orleans District, consists of a 12-foot by 150-foot channel from Lake Borgne and a 12-foot by 150-foot channel from the Mississippi River to the Sabine River. Also included is a channel from Morgan City to Port Allen and the Franklin Canal, running from the main waterway to Franklin. Eight locks are part of the waterway.(17)

Houma Navigational Canal

This is a 15-foot by 150-foot channel from the Gulf Intracoastal Waterway outside Houma, to Houma, to the Gulf of Mexico.(18)

Mermentau River

This is a 6-foot by 60-foot channel from the Gulf Intracoastal Waterway at the south end of Lake Arthur, through White Lake to Schooner Bayou and Fresh Water Bayou. Also included is a channel from Grand Lake through Mud Lake to Vermilion Bay and two water-control structures at Catfish Point and Schooner Bayou.(15)

Mississippi River, Baton Rouge, to the Gulf of Mexico

This channel is 40 feet by 500 feet between New Orleans and Baton Rouge, 35 feet by 1,500 feet in the New Orleans Port limits and 40 feet by 1,000 feet from New Orleans to the Head of Passes. Channels at the passes include: Southwest Pass, 40 feet by 800 feet; Southwest Pass bar channel 40 feet by 600 feet; South Pass, 30 feet by 450 feet; and South Pass bar channel, 30 feet by 600 feet.(20)

Mississippi River - Gulf Outlet

This is a 36-foot by 500-foot ship channel from the 38-foot contour in the Gulf to a point about 76 miles inland, a connecting channel with the New Orleans Inner Harbor Navigational Canal, and a lock connecting the channel with the Mississippi River.(21)

Louisiana Department of Highways

The Louisiana Department of Highways plans the following new highway construction in the Louisiana coastal zone.(22)

State Highway 82

Extension of the highway to the coast in the area east of Pecan Island and Paul J. Rainey Wildlife Refuge is planned.

U.S. Highway 90

Extension of the divided highway from Jeanerette to the vicinity of Patterson, then from Morgan City to the Des Allemands area is planned.

State Highway 1

Extension from the Donaldsonville area along the west bank of the Mississippi River to intersect the proposed Interstate 410 loop and U.S. 90 at Boutte is planned.

Interstate 410

Southern loop around New Orleans to run from I-10 north of Kenner across the Mississippi River to Boutte, then east and across the Mississippi River near Chalmette, intersecting I-10 north of Chalmette is planned.

LaRose - Interstate 410

Highway from State Highway 308 south of LaRose in a north-easterly direction to intersect Interstate 410 in the area of State Highway 45 is planned.

Soil Conservation Service

The Soil Conservation Service has responsibility for developing watershed projects in Louisiana. The diagram in Fig. A4, "Status of Watersheds - Louisiana," shows the general size and location of the projects in the Louisiana coastal zone. Generally these projects are divided into four categories with respect to the stage of construction and these are discussed below.

I. Projects for which Applications have been Received.(23)

Number on Diagram	Name	Acreage (thousand acres)
30	Little Chenier	30.0
32	Grand Chenier	23.5
31	Little Pecan	45.0
36	Bayou Mallet	108.0
29	Bayou Plaquemine Brule	242.0
71	Bayou Queue de Tortue	195.0
68	Bayou Plaquemine	151.5
62	East Ascension	107.4
28	Slidell	56.3

II. Projects Approved for Planning(24)

Number on Diagram	Name	Acres (thousand acres)	Construction Included
38	Choctaw Bayou	110.0	-
59	Lake Verret	246.0	230 miles of multipurpose channel improve- ments.(25)
12	Bayou Black	152.0	-

STATUS OF WATERSHEDS - LOUISIANA

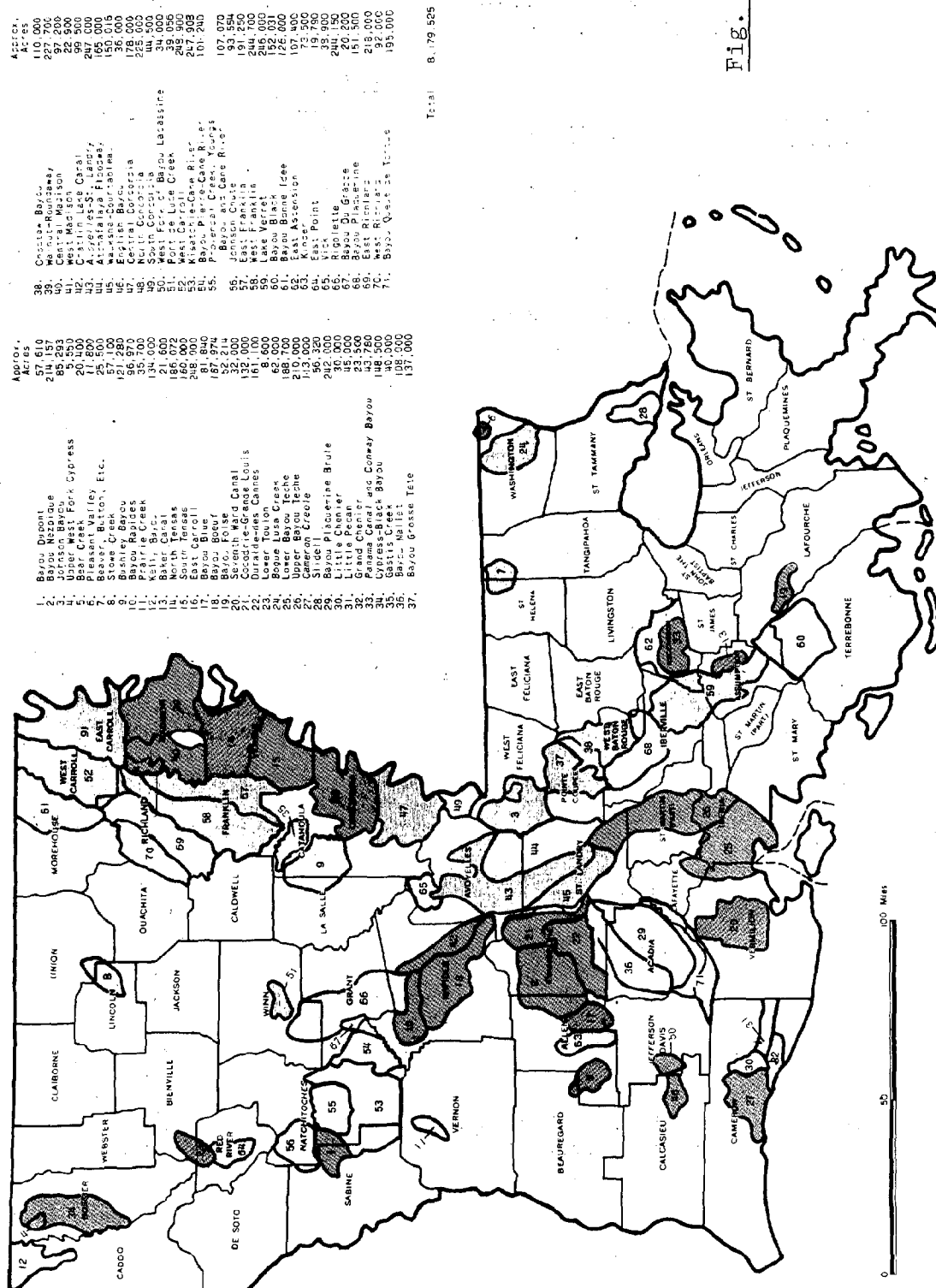


Fig. A-4.

III. Projects for which the Work Plan has been Approved
for Operations

<u>Number on Diagram</u>	<u>Name</u>	<u>Acreage (thousand acres)</u>	<u>Construction Included</u>
46	English Bayou	36.0	44 miles of channel improvements with erosion control structures (26).
27	Cameron Creole	210.0	19 miles of flood protection levees, 35 miles of channel improvements and 6 multipurpose water control structures (27)
50	West Fork of Bayou Lacassine	34.0	83 miles of channel improvements with control structures for channel protection.(28)
25	Lower Bayou Teche	188.7	132 miles of multi-purpose channels (29)
26	Upper Bayou Teche	210.0	265 miles of multi-purpose channels (30)
19	Bayou Folse	52.2	19.9 miles of channel improvement, 4.4 miles of channel excavation and 36.2 miles of levee improvements for flood protection.(31)
33	Panama Canal and Conway Bayou	43.8	25 miles of channel improvements.(32)

IV. Projects which have been Completed

<u>Number on Diagram</u>	<u>Name</u>	<u>Acreage (thousand acres)</u>	<u>Construction Included</u>
20	Seventh Ward Canal	32.0	3.3 miles of levee, 4 water control structures and 39.6 miles of multipurpose mains and laterals(33)
13	Baker Canal	21.6	-

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APPENDIX THREE
MARINE SCIENCE EDUCATION IN LOUISIANA

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I. Overview

Of the state's 22 state-supported and 13 nonpublic institutions of higher learning, two have degree programs in marine science. In addition, seven of the other institutions offer selected courses in marine sciences.

A. Degree Programs

1. Louisiana State University - Baton Rouge

The Department of Marine Sciences at Louisiana State University in Baton Rouge offers graduate degree programs leading to the M.S. and the Ph.D. degrees in a wide variety of marine-related fields of interest. The degree programs are interdisciplinary and multidisciplinary and include courses taught in several other departments in the University. Overall emphasis is given to the understanding and practical application of knowledge concerning the physical, chemical, geological, biological, economic and legal aspects of marine environments. About 35 graduate students are enrolled in degree programs in the department.

The department was established in 1968 and is associated with the Office of Sea Grant Development and the Coastal Studies Institute. These three units comprise the Center for Wetland Resources at LSU-BR.

2. Nicholls State University

The university offers a B.S. degree in marine biology through its Department of Biological Sciences. Courses in the degree program include offerings in marine ecology, fishery management, ichthyology, parasitology and earth science. The university has a newly established marine research laboratory at Pass Fourchon scheduled to begin operations soon.

B. Marine-Oriented Courses in Louisiana Universities

A variety of marine-oriented courses is available in at least eight of the state's universities. Five of the state's universities have affiliation with Gulf Coast Research Laboratory at Ocean Springs, Mississippi. This institution provides marine science courses which attract students from Louisiana and at least 10 other states. The affiliation of Louisiana universities with Gulf Coast Research Laboratory exists, in some instances, because there is no similar facility in Louisiana.

C. Trade and Vocational-Technical Schools

Of the 32 trade and vocational-technical schools in the state, at least one has a Department of Marine Science. That school, the Young Memorial Vocational-Technical School, conducts a program in marine boat operation for pre-service and in-service employees in the marine industries of coastal Louisiana. One school teaches aircraft maintenance; three teach diesel mechanics and fifteen teach electronics. These and other instructional programs supply skilled workers, but in insufficient numbers, to Louisiana marine industries. At least two private, proprietary schools help prepare students for Coast Guard administered examinations.

No school or junior college in the state provides a two-year degree program in marine technology. Such programs are available in Texas, Florida, California and several other coastal states.

D. Marine Science Education in High Schools

Marine science education in high, middle and elementary schools can be of a vocational nature or an academic nature. Only one high school in the state, South Terrebonne High School, has a program in marine operations. This vocational program involves about 30 high school seniors being prepared for employment in boat operations and related marine activities.

Throughout the United States, upwards of a thousand high schools have developed academic programs in marine science. Typically, such programs consist of a one-semester or year-long course in some aspect of marine science, e.g., marine ecology, marine biology and oceanography. These programs exist in virtually all coastal states except Louisiana.

II. Louisiana's Needs in Marine Science Education

There is no indication at present that additional graduate programs in marine science are needed in the state. The existing program at LSU-BR enrolls about 40 graduate students, a level of production which will meet the state's needs during the next one or two decades.

The graduate program at LSU-BR is supported largely by Sea Grant and other federally funded programs. The Center for Wetland Resources at LSU-BR is too much a "soft money" operation, dependent on federal grants and programs. The state should provide more direct support to the center which includes the Department of Marine Sciences.

The baccalaureate degree program in marine biology at Nicholls State University is a successful program, which should be encouraged to grow and develop. Other universities in the state should consider developing a baccalaureate degree program in marine science, with special emphasis on nonbiological options. This need seems to be real on the basis of the large number of inquiries received by the LSU Department of Marine Sciences from Louisiana students and from students in other states and nations. Before initiating any new biologically oriented undergraduate programs, the present capabilities of Nicholls State, University of Southwestern Louisiana and Southeastern University should be assessed fully.

A rather urgent need exists for the development of a **two-year** Associate Arts degree program in marine technology. The marine technology program would provide persons qualified for employment in the marine transport, fisheries and offshore petroleum industries. Many persons employed in these Louisiana industries are inadequately trained. Moreover the highest paying jobs often are filled by out-of-state persons, owing to the scarcity of well-trained local people.

The state does an insufficient job of providing a pool of well-trained, efficient marine-oriented technical people such as boat pilots, marine diesel technicians, able bodied seamen and other job categories needed in the coastal-marine industries. The marine program at Young Memorial Vocational-Technical School should be expanded and provided additional state support. The newly established trade school at Houma should also be provided with the support it needs to develop a program to train qualified personnel to fill jobs in the marine-oriented industries of the state.

The state should develop an overall plan for the inclusion of marine-related topics in its school curricula from kindergarten to the twelfth grade. This can be done by

developing appropriate curricular material and an adequate program of pre-service and in-service training for teachers. Louisiana should not lag behind other coastal states in marine science education.

III. Marine Education and Research Laboratories

The Louisiana Wild Life and Fisheries Commission operates at least three research laboratories in the coastal zone. These facilities are located at Pass a Loutre, Grand Terre and the Rockefeller Wild Life Refuge and Game Preserve. The laboratory at Grand Terre is most directly concerned with marine research and education.

Nicholls State University has constructed a marine laboratory facility at Pass Fourchon. This facility is scheduled to begin operations in September of 1973. The University of Southwestern Louisiana owns a small estuarine research facility near Vermillion Bay and Louisiana State University at Baton Rouge operates a small marine research facility in a rented camp at Grand Isle. This temporary facility serves in the staging of the Sea Grant-funded research activities in Barataria Bay.

There is a need for a large university-operated marine research and education facility somewhere along the Gulf coast in Louisiana. All coastal states have some version of such a facility except Louisiana. We should not farm our marine students out to Texas and Mississippi for training to do their field research on marine subjects. The facility should be large enough to house at least 90 students and should provide leadership in research of the Gulf of Mexico in a way that Scripps Institution of Oceanography (La Jolla, California) does for the Pacific and Woods Hole Oceanographic Institution (Woods Hole, Massachusetts) does for the Atlantic.

APPENDIX FOUR

COMMISSION ACTIVITIES

Commission activity was divided into three broad phases: Orientation, analysis and preparation of the final report. Initially, meetings of the full commission were conducted monthly. Various technical presentations were made by persons having special interest or expertise relating to the Louisiana Coastal Zone. Briefly, these presentations included:

<u>Name</u>	<u>Date</u>	<u>Subject of the Presentation</u>
Dr. Sherwood M. Gagliano	Dec. 13, 1971	Geological and hydrological overview of the coastal zone.
Dr. Lyle S. St. Amant	Jan. 18, 1973	Living resources production and management
Mr. Gene Cretini	Feb. 29, 1972	Role of industry in the coastal zone
Mr. Robert Flaherty	Feb. 29, 1972	Oil and gas in the coastal zone
Dr. Doyle Chambers	March 21, 1972	Agricultural concerns in the coastal zone
Mr. William C. McNeal	March 21, 1972	Needs and benefits of water transportation industry
Mr. Gillis Long	April 5, 1972	Environmental and economic consequences of a super-port for Louisiana
Mr. Fredrick Chatry	May 3, 1972	Water resource projects from viewpoint of the federal government

Mr. Daniel Cresap	May 3, 1972	Water resources management from the state's point of view
Dean Gerald McLinden	May 31, 1972	Education and cultural aspects of the coastal zone
Mr. Richard Bryan, Jr.	May 31, 1972	Environmental and recreational facets of the coastal zone
Mr. W. L. Manning	June 21, 1972	Coastal zone management from the view point of the landowner
Mr. William Beller	July 27, 1972	General principles of coastal zone management and experiences directing coastal zone management programs in Hawaii, the Virgin Islands and Puerto Rico

Concurrent with the technical presentations listed above, the Commission conducted discussions with respect to land use laws generally, and more specifically with respect to amendments to Act 35 and the federal Coastal Zone Management Act of 1972.

The Commission then entered the analysis, or second phase of its study. Public hearings were held in five major coastal communities; Lafayette, Thibodaux, Lake Charles, Chalmette and Morgan City in an effort to obtain reaction of citizens to the Commission's efforts. Specifically, the objectives of the meetings were to develop five main points:

1. To receive information on local natural resource use and problems.

2. To provide an opportunity for presentation of all view points.

3. To inform citizens that the coastal zone management study was being conducted and that their interests might thereby be affected.

4. To educate the public to the need for coastal zone management, and

5. To inform the public of the activities of the Louisiana Advisory Commission on Coastal and Marine Resources.

Five standing committees and three special committees were formed to study specific problem areas. The standing committees addressed themselves to: Living Resources, Industrialization and Urbanization, Water Resources, Transportation and Recreation, Tourism and Culture. The three special committees conducted studies on: Managing Authority of the Commission, Research and Education and Ocean Engineering and Development. The committees had responsibility for developing principles which would form the basis of the coastal zone management program. Written reports setting forth adopted statements of the problems, proposed principles of coastal zone management, an approved bibliography and reference sources, and a general review of the committee activity since its formation were submitted by each committee.

The third phase of the study was devoted to assembling and writing the final report.

The Commission established an official journal, the index of which follows this section. A relatively small number of complete copies of the journal will be available and they will be placed in central libraries around the state.

The Commission also published two interim reports. They coincide with completion of the first and second phases of the study and reflect the information developed during the preceding stage of the study. The first report was entitled Louisiana Government and the Coastal Zone - 1972 and was published March 31, 1972. The second report is entitled Wetlands '73: Toward Coastal Zone Management in Louisiana and was published in March of 1973. Copies of both these reports are still available.

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